IMPROVING EMERGENCY AIRWAY CARE AT A CRITICAL ACCESS HOSPITAL

By

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Abstract

Emergency airway care is of the highest priority in caring for patients arriving at the emergency department with critical injuries and conditions. Intubation via laryngoscopy is the gold standard for placing an endotracheal tube to manage ventilation. In rural areas, emergency airway care is often the responsibility of non-expert providers who rarely have the opportunity to perform this life-saving procedure. These less experienced providers often take a longer time and make more attempts at endotracheal intubation. Multiple attempts and increased time taken to secure an airway are associated with higher morbidity and mortality. A critical review of the literature supports that video laryngoscopy increases first pass endotracheal intubation success. Video laryngoscopy is associated with faster intubation times and an improved view of glottic structures. This evidence-based quality improvement project implemented training and simulation in the use of video laryngoscopy for non-expert providers. After implementation of this quality improvement project, findings demonstrated an improved confidence with use of video laryngoscopy, increased confidence that video laryngoscopy is associated with improved visualization of glottic area and increased confidence associated with first pass of the endotracheal tube in non-expert providers using laryngoscopy to perform endotracheal intubation.

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Chapter 1. Background and Significance

When patients present to the emergency room with cardiac problems, trauma, or other conditions that leave them unable to maintain their airway, securing that airway is of the highest priority in resuscitation. The brain needs a continual supply of oxygen and nutrients to function. Without this supply of oxygen, the sensitive brain cells begin to die within 5 minutes, leading to brain hypoxia and eventually, death (Vigneron et al., 2016). To oxygenate unconscious patients and prevent brain injury, an artificial airway called an endotracheal tube (ETT) is inserted. Laryngoscopy is the technique used to perform endotracheal intubation.

Laryngoscopy has long been the standard in airway management and is considered the definitive procedure when securing a patient's airway. In larger healthcare facilities located in populated areas, having an available clinician experienced in intubation does not usually present a problem. In rural areas, that is not always the case (Kabrhel, Thomsen, Setnik, & Walls, 2010).

In this chapter, current practice for intubation in rural areas will be examined, including: who typically performs this life-saving procedure, and whether there is a disparity among skill levels of emergency care specific to endotracheal intubation. I will also review the importance of this issue in rural areas of Alaska where there have been recent changes to the Alaska administrative code for emergency medical services.

Background

Orotracheal intubation is accomplished by visualizing the larynx, inserting an ETT into the trachea and inflating a cuff on the tube. The purpose of a cuff on an ETT is to mitigate aspiration, a dangerous complication of intubation that results from the stomach contents flowing into the trachea (Kabrhel et al. 2010). Emergency intubation is usually performed in an unconscious or paralyzed patient to administer positive-pressure ventilation that cannot be delivered or sustained via mask ventilation.

The trachea lies superior to the esophagus in the supine position, making this the usual patient position when laryngoscopy is performed. Occasionally, persons attempting laryngoscopy intubate the esophagus rather than the trachea. Unless this is recognized quickly, hemodynamic stability becomes compromised leading to cardiac dysrhythmias and hypoxic brain injury which can lead to death (Sakles, Chiu, Mosier, Walker & Stolz, 2013).

Miller (2015) describes several techniques for placing an endotracheal tube; the two most recognized standards include direct laryngoscopy (DL) and video laryngoscopy (VL). DL involves using a laryngoscope which is held in the non-dominant hand. Either a McIntosh or Miller blade is attached to the handle providing power and light that allows for direct visualization of the larynx. This technique is dependent on the flexion of the neck and extension of the head in an attempt to align the oral, laryngeal, and pharyngeal axis to obtain a direct view. DL has been the technique that most veteran providers use in initial training. In the early 2000's, VL became available and continues to gain popularity. VL has a camera at the distal tip of the blade, transmitting video to a screen, which is either attached or not attached to the laryngoscope. Aligning the oral, laryngeal, and pharyngeal axis is not required in VL. Instead the needed glottic view is achieved via an indirect or direct method (Chemsian, Bhananker, & Ramaiah, 2014).

Intubation is most often performed by anesthesia providers. However, emergency intubation may be executed by providers from a range of medical personnel including emergency medical technicians (EMT), flight nurses, and emergency department (ED) providers as well as other specialized disciplines. Providers who are less experienced often require more attempts at intubation. Multiple intubation attempts in an emergency are associated with a higher incidence of adverse events when compared to a single attempt (Sakles, et al., 2013).

This life-saving procedure initiated under stressful situations often involves several component tasks including assessing the airway, estimating the degree of difficulty, determining the need for pharmacological adjuncts, using rapid sequence induction, and managing a “can’t intubate, can’t ventilate” scenario. It is for these and many other reasons that many anesthesia clinicians consider this life-preserving skill to be a vital component of emergency care (Apfelbaum et al., 2013).

In urban and most suburban communities, healthcare providers trained in airway management are readily available. This is not always the situation at a rural critical access hospital (CAH). The CAH has been designated an eligible rural hospital by the Centers for Medicare and Medicaid Services (CMS) (CMS, 2019). The CMS classification is designed to reduce the financial vulnerability of rural hospitals and improve access to healthcare by keeping essential services in rural communities.

CMS has designated that a CAH hospital must be in a rural area located more than 35 miles from another hospital and maintain no more than 25 inpatient beds. CAHs are required to provide 24-hour emergency services, seven days a week. Either a Medical Doctor (MD), Doctor of Osteopathic Medicine (DO), Nurse Practitioner (NP) or Clinical Nurse Specialist (CNS) is required to staff a CAH and be onsite within 30 minutes on a 24-hour basis. Registered Nurses are required to provide coverage 24 hours a day seven days a week. Surgical and anesthesia services are optional at a CAHs (CMS, 2019). The providers covering Providence Valdez Medical Center (PVMC) are from the family medicine discipline. Family practice physicians are exposed to intubations in their coursework and residency. However, the vast majority do not regularly perform laryngoscopy and intubation in their practice. With disciplines who specialize in intubation being called first for intubations, family practice physicians may have few opportunities to train for intubation.

Until very recently, patients in Alaska who called Emergency Medical Services (EMS) in need of emergency airway care, could have been intubated before arrival at the hospital by a trained Emergency Medical Technician (EMT). After September 23, 2019, EMT-3 were no longer authorized to intubate and were only authorized to insert a supraglottic airway (SGA), which does not protect against airway aspiration. This change in the EMT scope of practice from the Alaska Department of Health and Social Services may result in increased reliance on CAH ED physicians to intubate, due to the fact that the patients will not be intubated earlier in the prehospital setting (August 2019 EMS regulations update, 2019).

Problem Statement

PVMC is a CAH located in rural Alaska with eleven acute-care beds and ten long-term care beds and also offers several inpatient and outpatient services. A solo licensed anesthesia provider furnishes anesthesia coverage for several services/departments, to include obstetrics, surgical services, and the ED. When the anesthesia provider is unavailable, the hospital is staffed with family practice or locum tenen physicians which vary in their experience and confidence with intubation. During the timespan from early 2018 to mid 2019 at PVMC, several unsuccessful attempts of endotracheal intubation performed by non-expert providers made it necessary for the anesthesia provider to intervene in 8 out of 11 (72%) intubations. Prompt and correct intubation of a critically ill patient is vital to reducing complications and promoting survival.

Key stakeholders related to this challenge of non-expert intubations include the hospital administration who have expressed interest in addressing this problem. Non-expert providers who have the responsibility of intubating have a vested stake in improving their skills. The patients needing emergency airway care in this rural location are stakeholders as well. The PICOT question for this project is as follows; In non-expert intubation providers, will simulation training in VL improve perceived confidence and successful intubation rates, decreasing attempts to within two when compared to traditional DL?

Jeffries (2005) articulated that simulation training imitates the realities of practicing in clinical circumstances that are constructed to demonstrate critical thinking, decision-making skills, and procedures. These detailed simulations, closely resembles the actual complexity of the situation/s.

Healthcare clinicians are faced with situations that require immediate decisions that must be made both expeditiously and effectively. Self-confidence acquired from previous experiences adds to the clinician's ability to make decisions. Simulation can offer clinicians the ability to make quick clinical decisions in a learning environment without the potential for patient harm (Bambini, Washburn, & Perkins, 2009).

The intervention proposed in this project will be training and simulation in VL for non-expert intubation providers. Based on the literature, this training is anticipated to equip novice providers with additional airway knowledge and skills. VL is associated with higher first pass of the endotracheal tube (p = .008), lower esophageal intubations, faster response times (p = .048), and a decreased number of intubation attempts (Arulkumaran et al. 2018; Vanderbilt, Mayglothling, Pastis, & Franzen, 2014). VL simulation has been shown to increase success in endotracheal intubation (Parmekar et al., 2017).

Chapter Two: Critical Appraisal

Emergency airway care is at the core of caring for trauma and critically ill patients. Endotracheal intubation, accomplished by laryngoscopy, has long been the standard management and is considered the definitive procedure when securing a patient's airway. Less experienced providers often require more attempts at intubation. Multiple attempts while performing emergency intubation are associated with a higher incidence of adverse events, as compared to a single attempt (Sakles, et al., 2013).

In rural areas, non-expert individuals often have the responsibility of securing the airway of patients seen in the emergency department. This type of procedure is a low frequency, high consequence occurrence. A critical review of the literature examined video laryngoscopy (VL) as compared to direct laryngoscopy (DL) to determine advantages in providing management of patients needing emergency airway care.

Methodology

A search was conducted for studies comparing VL versus DL in terms of success rate, time to successful intubation, and confidence level of providers performing intubations. Studies sought were for multidisciplinary novice or non-expert providers. The setting searched was for non-operating room, emergent orotracheal intubations.

Strategies. The databases used to find relevant studies included the Cumulative Index of Nursing and Allied Health Literature (CINAHL), PubMed, and Google scholar. The search terms used were video laryngoscopy and non-expert providers as a keyword, laryngoscopy, intubation, direct laryngoscopy, training, and confidence as subject headings. The CINAHL search was narrowed to the English language and limited to publication dates 5 years or earlier. Using the search terms with the Boolean connector "and" CINAHL resulted in a search that was too narrowly defined, yielding zero studies. The subject heading confidence was removed, with one article available in search results. Removing the subject heading non-expert increased the search to 45 articles. Following title review and abstract evaluation, 41 articles were found to have alternate areas of interest such as difficult airway, nasotracheal intubation, pain, posture, and intubations performed by expert providers that did not fit search parameters. After removal of duplicate articles, a total of three articles remained.

Pubmed was searched using the same parameters with a result of nine articles. Removing duplicate articles left one article fitting selection criteria. Google Scholar resulted in 18 articles, with six articles found usable after removing duplicates and those that did not meet the criteria. Searching the bibliographies of database articles, five articles were found useful. Selection criteria included studies that were evaluating VL as compared to DL in first attempt intubation, time to successful intubation, and confidence in the non-expert provider. The study population was not limited, to reflect all ages and gender of patients who require emergency airway care. Studies found in the literature review included five systematic reviews and meta-analysis, one retrospective study and nine randomized control trials.

Data evaluation. Critical appraisal tools utilized were from the Center for Evidence-Based Management's critical appraisal checklists (Kim & Ahn, 2015), and rapid critical appraisal checklists from Melnyk and Fineout-Overholt (2015). Data evaluated for applicability to the PICOT of interest included whether the study addressed a similar query compared to the PICOT question. Patient populations in the studies were determined to be congruent to the patient population of the current practice setting. The feasibility of implementing study results at current site of practice was considered. Consistencies of results across studies were also contemplated (see Appendix A).

Critical Appraisal

The final steps in critical appraisal included examination of clinical outcomes among the studies reviewed. This was to determine if the target populations of the studies reviewed were consistent and applicable to the current practice site. Evaluation and feasibility of implementing findings to practice site were also considered.

Evaluation. Evidence examined was in the English language and all published within five-years, except for older studies located in references of searched studies. All studies compared VL with DL for emergency first attempt intubation in non-expert providers.

Setting for all studies was outside the operating room, except for one randomized controlled trial (RCT) that looked at obstetrical patients. Most studies included secondary outcomes which, included ranking and classification of airway, incidence of esophageal intubation, and intubation related complications. A majority of studies had similar sampling selection with common exclusion criteria such as patients undergoing surgery, patients with trauma, or receiving cardiopulmonary resuscitation. The project discovered five systematic reviews and meta-analysis which looked at RCTs, with the highest level of evidence (LOE) of one. No threats to internal and external validity were distinguished. All reviews looked at patient data as opposed to aggregate data. Results were consistent across the studies reviewed. Arulkumaran et al. (2018) looked at (RCTs), observational studies (prospective and retrospective), and propensity-matched analyses (N=32). Their results included greater first-pass intubation with VL compared with DL amongst novice/trainee clinicians ($p < .001$). Griesdale et al. (2011) showed increase glottic visualization ($p < .1$) in their meta-analysis of RCTs (N=17).

Lewis et al. (2016) considered (*N*=64) randomized controlled trials and quasi-randomized studies that included adult patients undergoing laryngoscopy performed with a VL or DL in a clinical, emergency, or an out-of-hospital setting. An improved view was reported ($p < .00001$) utilizing the Cormack-Lehane scale. Rombey, Schieren, & Pieper (2018) suggested routine use of VL for airway management in emergency medicine might improve patient safety, as VL is associated with a lower number of intubation attempts and with a lower frequency of esophageal intubation.

Nine randomized control trials with a LOE second highest rating of two were identified. Researchers used sound scientific methods to obtain their study results. All subjects appeared to be aware they were in an experimental environment, and this seems to not have had a reactive arrangement effect. Most groups participated in both VL and DL proportionally. Due to the nature of the intervention, all subjects were unable to be blinded, which could potentially create a risk of performance bias. Aghamohammadi et al. (2015) randomized 50 volunteers using numbering, the odd numbering assigned to group one, and even numbers assigned to group two. There was no mortality reported within the groups. Results of this study demonstrated routine airway intubation using VL proved significantly faster than DL ($p < .05$). Berg et al. (2009) used volunteers from the armed forces to participate in an IRB approved RCT that specifically looked at the training of novices in VL and DL. Forty-three subjects were selected after seven participants were excluded due to incomplete data. None of the subjects had more than five previous intubations. Subjects were randomized and sequenced to perform DL, followed by VL intubations attempts. This study demonstrated that VL had improved visualization over DL ($p < .0001$) and that VL training was rapidly accomplished in novice military healthcare providers.

Lascarrou et al. (2017), compared DL and VL intubations in *N*=371 randomized patients. They reported a low risk of bias and high external validity. This RCT did not find any improvement in the first pass of the ETT using VL as compared to DL. However, they did recommend VL over DL in the case of a known difficult airway. Myatra et al. (2019), looked at *N*=144 American Society of Anesthesiologists (ASA) grade I–II pediatric patients who were randomly assigned to be intubated by twenty-four novice anesthesia residents. The first attempt intubation success rate was significantly higher in the VL group when compared with the DL group (83.3% vs. 44.4%). The authors concluded that that VL instruction given to trainees resulted in a higher intubation success rate and reduced complications during intubations when compared with DL with conventional instructions. Toker, Altiparmak, and Karabay (2019) conducted an RCT after obtaining IRB approval looking at intubation times in *N*=100 patients undergoing elective cesarean section between the ages of eighteen and forty. After following a predetermined exclusion criterion, patients were randomized by number created by the computer and then sealed in an envelope. Patients were randomly allocated to one of two groups. VL significantly reduced the time taken to obtain the glottic view compared with the time taken in the DL group ($p < .05$).

A LOE rating of 3 retrospective study looked at endotracheal intubations at a tertiary academic hospital over a forty-eight-month period. These intubations were performed by non-anesthesia providers, which included providers with varying experience in intubation. The study looked at *N*=958 patients intubated with either VL or DL. The first attempt success rate was higher with VL ($p < .001$).

Synthesis. The findings of the majority of studies reviewed showed VL provided higher success rates at first attempt intubation as compared with DL. Arulkumaran et al. (2018) found

VL to have a 73% improvement versus 63% for DL. Baek et al. (2018) found overall first attempt intubation success rate was 79% for VL and 59% for DL. Toker et al. (2019) found that DL took longer on average to intubate (40 seconds vs. 34 seconds) as compared to VL. Rombey et al. (2018) found that VL was associated with a lower number of intubation attempts and also a lower number of esophageal intubations. They reported that routine use of VL may be associated with improved patient safety.

All studies used a combination of sedation or general anesthesia. Intubations were supervised by an experienced operator when laryngoscopy was being performed by novice clinicians. Most studies allowed two attempts by the non-expert clinician, and the third attempt was performed by an expert provider. Several studies indicated an improved training curriculum for non-expert providers in VL would be beneficial in future research.

Secondary outcomes were shared among most of the studies. These included a decrease in time to intubation. Another shared secondary outcome was increased visualization of the glottic area when using VL. This was documented via the Cormack-Lehane classification system, which documents a glottic view based on structures seen. This increased visualization led to decreased esophageal intubations (see Appendix B).

Summary of Evidence

Most studies reported that non-expert clinicians had higher successful first attempt intubation rates associated with VL when compared to DL (see Appendix C). Routine use of VL for airway management may improve patient safety, as VL is associated with a lower number of intubations attempts (Ambrosia et al., 2014; Arulkumaran et al., 2018; Baek, et al., 2018; Griesdale et al., 2011; Howard-Quijano et al., 2008; Lewis et al, 2016; Myatra et al., 2019; Rombey et al., 2018; Vanderbilt et al., 2014).

Time of intubation generally reported as time from laryngoscope entering patients mouth to conformational detection of end-tidal carbon dioxide. For non-expert providers, several studies indicated that VL intubation time was significantly faster than DL (Aghamohammadi et al., 2015; Ambrosia et al., 2014; Griesdale et al., 2011; Toker et al., 2019; Vanderbilt et al., 2014).

Several studies noted a lower frequency of esophageal intubation rates with VL. Its use in emergency airway care may enhance patient safety and improve outcomes (Howard-Quijano et al., 2008; Myatra et al., 2019; Rombey et al., 2018). The improved rate of successful intubation, the decreased rate of esophageal intubation and faster time of intubation support the use of VL for tracheal intubation training. Evidence suggests that simulation-based training is an effective way to teach VL skills, offering skills that are transferable to DL (Berg et al., 2009; Howard-Quijano et al., 2008; Myatra et al., 2019; Parmekar et al., 2017; Vanderbilt et al., 2014).

Several studies indicated improved visualization of the glottic area. This can be associated with higher successful intubation rates (Berg et al., 2009; Griesdale et al., 2011; Lewis et al, 2016).

Limitations

The majority of studies noted that the variable of clinician intubation expertise limited the generalizability of the results. When a clinician has strong knowledge and experience intubating, the success rate is already high, and VL does not increase the success rate with any significance (Arulkumaran et al., 2018; Griesdale et al., 2011). VL is more effective for clinicians with limited intubation experience as compared with experience operators (Arulkumaran et al., 2018). Several studies did not randomly assign clinicians to a mode of intubation (VL or DL), which increased the possibility of selection bias (Baek, et al., 2018; Lewis et al. 2016). The researchers allowed clinicians to choose the laryngoscopy technique according to their preference. Most studies only allowed a single type of VL (Lascarrou et al. 2017; Baek, et al., 2018). Blinding was not possible for the majority of the studies (Arulkumaran et al., 2018; Lascarrou et al. 2017). Patients who had a difficult airway were typically intubated by experienced clinicians.

Conclusion

In conclusion, VL offered significantly lowered intubation times ($p < .05$), as well as an improved view of glottic structures ($p <.0001$) as compared to DL (Toker et al., 2019). Additionally, Arulkumaran et al. (2018) reported more significant success in first-pass emergency intubation and fewer esophageal intubations among less experienced clinicians ($p < .001$). Lascarrou et al. (2017) indicated that among ICU patients in France, VL compared with DL did not improve first-pass orotracheal intubation rates. The authors shared their opinion that VL should be available for use when encountering the difficult airway.

Several studies indicated that multiple video laryngoscopes were available, while others utilized only one particular scope (Griesdale et al., 2011; Lewis et al, 2016; Toker et al., 2019). Further research into the different models available for VL, specifically for the non-expert operator, may be beneficial.

While the literature is mixed, it is noteworthy to mention that VL is purported to have a higher success rate at first attempt intubation, a superior view, decreased intubation time and a decrease in esophageal intubations (Arulkumaran, 2018; Baek, 2018; Toker et al., 2019). The PICOT question for this project is as follows; In non-expert intubation providers, will simulation training in VL improve perceived confidence and successful intubation rates, decreasing attempts to within two when compared to traditional DL? This question has compelling, though not overwhelming, evidence to support the query.

Chapter 3. Organizational Framework or Evidence Based Practice Model

Within the regulations for CAH, the discipline of anesthesia is considered optional (CMS, 2019). Often CAH's that do not have anesthesia, or the availability of anesthesia services rely on providers, who may be less experienced in airway management. These providers have the responsibility of securing the airway during emergencies.

Based on a critical review of the literature, VL use is associated with increase first-pass intubation rates, faster intubation times, and improved view of the glottic area. This improved rate of successful intubation and the decreased rate of esophageal intubation support the use of VL for tracheal intubation training. The purpose of this QI project is to provide evidence-based training on VL, utilizing simulation. Evaluation of the project will include measures for changes in first pass of the endotracheal tube, confidence with intubation, improved laryngeal view of glottic opening, and decrease number of intubations attempts at PVMC.

Lippitt's Theory of Planned Change is a seven-step theory that emphasizes the role and responsibility of the change agent rather than the evolution of the change itself (Lippitt, Watson & Westley, 1958). This change theory seems uniquely appropriate to the target organization, in that there is only one anesthesia provider at this CAH. When anesthesia is unavailable, the only other providers available to perform emergency intubations are family practice physicians. Non-anesthesia physicians do not routinely perform emergency airway management and intubation.

As the anesthesia provider is generally considered the airway expert, it is intuitive that this individual operates as the change agent, facilitating the use of VL to improve emergency intubation skills. Lippitt's model builds on the work of Kurt Lewin and is also closely aligned with the nursing process. This would be a familiar model for problem-solving in the hospital environment (Geraci, 1997).

Evidenced-Based Practice Model

Lippitt, Watson, and Westley (1958) stated that they had been greatly stimulated by the ideas and examples of Kurt Lewin. They elaborated and extended on Lewin's model, which describes the process of change through three steps. Lippitt proposed a seven-step process that focused on the role of the change agent throughout the advancement of the change. In this model, the key to change has the right person to be the voice and support of change, empowering the process of development. Lippitt, et al., (1958) described the change evolvement: The decision to make a change may be made by the system itself, after experiencing pain (malfunctioning) or discovering the possibility of improvement, or by an outside change agent who observes the need for change in a particular system and takes the initiative in establishing a helping relationship with that system. (p. 16)

Lippitt's Phases of Change Theory (Lippitt, et al., 1958) includes seven detailed phases that facilitate change at the team level through democratic leadership, as opposed to an autocratic approach. This enhances the investment and favorable outcome in the change progression. The seven phases of change include:

1. Development of a need for change.

2. Establishment of a change relationship.

3. The clarification or diagnosis of client systems problem.

4. The examination of alternate routes and goals.

5. Transformation of intentions into actual change efforts.

6. Generalization and stabilization of change.

7. Achieving a terminal relationship.

Phases of the Change Model

At PVMC a CAH, a needs assessment survey was conducted in 2017 using questions in a Likert scale format to determine the current level of comfort for potential providers and support personnel in an airway emergency. This assessment distributed among various disciplines, including registered nurses, physicians, certified nursing assistants, and EMT personnel. With over 57 needs assessment results returned, the overwhelming majority of respondents indicated they were unprepared and lacked the requisite knowledge to assist with this life-saving procedure.

According to Lippitt's Theory of Change (Lippitt, et al., 1958), one must assess or diagnose the motivation and capacity for change when evaluating if the transformation should take place. In this first phase of Lippitt's Change Model, the decision for change became evident when non-anesthesia providers experienced unsuccessful attempts at endotracheal intubation. The anesthesia provider intervened and performed the intubation in a majority (72%) of the most recent intubations attempted by non-anesthesia providers. The administrators of the CAH petitioned anesthesia to help train providers who would be performing emergency intubations in the absence of anesthesia coverage. The family practice physicians indicated willingness and have been receptive to this prospect of airway training.

In phase two of Lippitt's Change Model, the establishment of a change relationship, motivation, and capability of change is assessed (Lippitt, et al., 1958). The hospital administrators have expressed interest in and desire to improve the emergency airway care at the facility. They have made time available for airway training and discussion in their regularly scheduled medical-staff meetings. The family practice physicians have requested help and training with performing intubations.

Financial considerations are expected to be minimal. The anesthesia provider is the quality improvement (QI) project team lead and will act as the change agent. The family physicians are independent of the CAH and have a personal interest in furthering their skills, becoming more capable of performing this infrequently performed lifesaving procedure. The CAH has purchased two different brands of VL. There is a maintenance contract with one video laryngoscope and no costs associated with the other scope. The CAH has in its inventory several simulators that have the capacity to train in airway skills, as well as access to high fidelity simulators at the local college.

In phase three, the clarification of the client system problem outlines the change agent's motivation, resources, experience, and dedication (Lippitt, et al., 1958). As the anesthesia provider championing this change process, I have 29 years of anesthesia experience in a variety of emergent airway settings. Given the average caseload during 29 years of anesthesia practice, the change agent has performed approximately 15,000 intubations and has completed education by regularly attending conferences and seminars in intubation and difficult airways. The motivation for the QI lead is to improve emergency airway management at the CAH when an anesthesia provider is not available.

Phase four of Lippitt's change theory includes the clarification or diagnosis of client systems problem. In this step, progressive change objectives are selected, the change process is defined, and action plans and strategies are developed (Lippitt, et al., 1958). The objectives for this project would be determined by the stakeholders, including the CAH administration, family practice physicians, and the change agent. Training would take place formally in the preexisting time slot of the med-staff meetings. Informal training would be on an individual basis mutually agreed upon by provider and trainer. The objectives for this project would include:

- Demonstrates confidence and familiarity of operation with VL.
- Explain the process and procedure demonstrating comprehension of VL.
- List and understand the four-step process.
- Demonstrates understanding of proper use of stylet techniques.

Strategies to improve practice and transfer knowledge would include:

- Assess comfort level and determine current knowledge of emergency airway management including VL.
- Develop action plan for establishing competencies.
- Demonstrate proper instruction and simulation with VL with pre-recorded video.
- Reassess and determine post intervention comfort level and current knowledge.
- Develop and scrutinize practice recommendations.

Phase five of Lippitt's change theory is transformation of intentions into actual change efforts. Here the role of the change agent is explained, and expectations are clarified (Lippitt, et al., 1958). The role of the change agent is to facilitate training and assess comprehension of those electing to endeavor in the instruction of VL. The purpose of the project is to improve intubation by improving skills and knowledge to providers who will be responsible for emergency intubations at this CAH. The stakeholders in this project are aware of the intentions and purpose of the change agent.

The sixth phase according to Lippitt's change theory, is generalization and stabilization of change. In this phase, change is maintained by facilitating feedback, enhancing communication, and coordinating the effects of change (Lippitt, et al., 1958). This phase could be achieved by reviewing learned skills and returning a demonstration of VL on a simulator. Additional information and knowledge obtained from new literature, continuing education seminars, etc., could be discussed in future med-staff meetings.

Lippitt's seventh and final phase of change theory involves achieving a terminal relationship, which gradually concludes the affiliation of the change agent (Lippitt, et al., 1958). In this stage, usually, the change agent gradually withdraws from their role, as change becomes part of organizational culture. In this particular project, the change agent would return to the role of anesthesia provider, available for consult or support as previously practiced.

Conclusion

Lippitt's change theory is well suited to bringing about the needed change in this project. Simulation-based training can yield skill transfer, providing a safe and effective way for health care professionals to practice and learn. This change in practice anticipates saving lives and reducing airway-associated complications, by improving first pass intubations by providers who sporadically perform this low frequency, high consequence occurrence (Vanderbilt et al., 2014).

Chapter 4: Project Design

Design

The purpose of this QI project is to improve intubation outcomes for non-expert intubation providers training and simulation experience in the use of VL. Due to the remoteness of location and unpredictability in occurrence of needed emergency intubation, the effectiveness of the training and the transition to VL will be assessed initially using a simulated scenario, as well as the success rate of actual intubations should they occur during the project implementation.

A chart review will be conducted to determine each participating provider's successful and unsuccessful actual intubations during the six months period immediately before the VL training and simulation is to be completed. After the VL simulation, another chart review will be conducted to determine effectiveness.

Melnyk and Fineout-Overholt, (2015) state to increase the dependability of a project, there should be more than one person conducting it. To increase dependability, the educational coordinator at PVMC will assist in the implementation of the training. A board-certified anesthesiologist will serve as an expert consultant to the project, reviewing evidenced-based airway training for VL.

Setting and Population

The project will be implemented at Providence Valdez Medical Center (PVMC), a critical access hospital (CAH) located in Valdez, a rural Alaska community. PVMC has 11 acute-care beds and 10 long-term care beds, 24-hour emergency services and obstetrical services. PVMC is designated as a Level IV trauma center.

Valdez, Alaska is located 305 road miles east of Anchorage and 364 road miles south of Fairbanks, the urban centers with the next closest higher level of care hospitals. During winter months, the road conditions are often challenging to travel. Often, the single road into Valdez is closed due to hazardous weather conditions, and flights, including emergency air transports, are often delayed for days.

The Valdez-Cordova census area has a population of just over 9,000 people, with approximately 4,000 people living in Valdez proper (U.S. Census Bureau, 2018). The diverse community includes a native population, US Coast Guard base, and numerous oil-related industries. This project will focus on improving the knowledge and skills of nonexpert intubation providers, although the greater benefit will be for members of the local community who rely on PVMC for competent intubation when needed. Stakeholders will include family practice physicians who provide medical coverage for emergency airway management when the single anesthesia provider is unavailable.

PVMC administrator and assistant administrator are also critical stakeholders in this project, expressing support for this planned practice change. Limitations of this planned project include a small population of six non-anesthesia intubation providers. The time constrictions of busy family practice providers and the single anesthesia provider may prove constraining.

Intervention/Practice Change

To ensure consistent delivery of the training intervention, VL education will be delivered via prerecorded video lecture. Views of how the VL scope is introduced into the patient’s mouth using dexterity and fine motor skills and views of the glottis approach via video laryngoscope will be demonstrated. Training and simulation will be conducted during regularly scheduled medical-staff meetings.

VL intubation procedure adapted from the manufacture's recommended operations manual and from Shah and Strayer's (2015) book "Essential Emergency Procedures." The step by step training will be adapted to the specific video laryngoscopes available at PVMC. The sequence of VL instruction will be as follows:

1. Open mouth with a finger/scissor technique.
2. Insert the VL device in the midline, staying opposed to the dorsal surface of the tongue.
3. Advance and rotate the blade around the tongue, staying in the midline, while watching on the video screen to identify key midline airway landmarks (uvula and tip of epiglottis).
4. Advance until the blade rests in the vallecula.
5. Gently tilt the blade and cranially bring the vocal cords into view on the screen. Do not place the device too close to the glottic inlet as this impedes tube passage.
6. Use a rigid pre-shaped or a rapid positioning intubating stylet.
7. Place the stylet-loaded endotracheal tube in the right corner of the mouth with the length of the tube parallel to the ground (3 o'clock position). Advance the tube while rotating the tube in a counterclockwise position until the tube aligns with the curvature of the blade (12 o'clock position). Advance the tube through the vocal cords. If unable to fully pass the tube, withdraw the stylet slightly to allow for more mobility.
8. Withdraw the stylet.
9. Inflate the cuff on the endotracheal tube.
10. Confirm tube placement with breath sounds, chest rise, and colorimetric or quantitative end-tidal carbon dioxide.

Measures

Self-reported measures will be utilized to determine outcomes of this DNP project. Measurement of objectives such as demonstration of increase confidence and familiarity of operation with VL as well as use of stylet techniques and the four-step process will be examined. A pre and post-survey was utilized to assess provider confidence, and preparedness in handling airway emergencies. The post-survey Likert scale including open-ended questions which asked participants to rate their readiness and how confident they rate themselves in handling intubations under emergent conditions. The Likert survey was developed by item generation through interviews with airway experts and literature review. The pre/post survey was validated in terms of content validity through expert reviews in February 2020. Four board certified anesthesiologists were consulted regarding the pre and post-survey, three responded and gave feedback regarding survey instruments. Three Certified Registered Nurse Anesthetists were contacted, and all gave input and feedback regarding the survey instrument. Three family practice physicians gave feedback and input regarding survey instrument. These experts gave feedback indicating that a non-specific confidence skill survey would not address the specifics of intubation and confidence as many patient variables such as individual anatomy, setting, and presentation of needed intubation, device specifics, first pass of the ETT and laryngeal view, and differences of glottic view for the different laryngoscope needed to be considered. The seven questions of the pre and post-surveys reported a good internal consistency with a Cronbach alpha score of .784.

A post-intervention Likert survey identical to the previous survey with the open-ended questions which will include perceived value of VL training will be distributed to participants after VL education and simulation. The survey will be implemented consistently among the providers, either by email or via paper version.

Observational measures will include number of successful or unsuccessful intubations in standard intubation simulations. The number of successful or unsuccessful intubations in difficult airway intubation simulations will also be recorded. This dichotomous successful or unsuccessful measure will be a nominal measurement.

Manipulation checks are an important assessment that determines whether or not the intervention was successfully conducted (Melnyk & Fineout-Overholt, 2015). A manipulation check will be performed sometime after the VL training and simulation to assess key concepts of VL education.

Data Collection

Readiness for this project has been addressed via a needs assessment survey using questions in a five-point Likert-scale format to determine the level of comfort for non-expert providers and support personnel in an airway emergency. The result of this survey indicated a high-level of unpreparedness and a desire for more training. Specifically, providers required to perform emergency intubation have asked for help with refining this skill. The other stakeholders include the hospital administrator, and assistant administrator/clinical lead who have previously made time available for similar training and indicates strong support to promote this training.

Preintervention, patient records will be reviewed to fully understand to establish current intubation practices. Using the Current Procedural Terminology (CPT) code 31500, previous emergency intubations will be searched within a two-year period from January 2018 through January 2020. Parameters sought in chart review will include:

- Final diagnosis of the patient.

- Intubation performed by novice or expert providers?
- If novice provider, was assistance with intubation required?
- How many attempts before successful intubation?
- What type of laryngoscope used?

A preintervention survey, rating confidence, and preparedness will be administered using a Likert scale. The VL training will be developed into a video by project director to implement the intervention. This video will be specific to PVMC equipment and procedures. Current guidelines will be used to implement the intervention consistently. This video will be specific to the brand and model of video laryngoscope presently in inventory at PVMC. Education of airway glottic visualization scales and scoring will be included. Implementation will take place during regularly scheduled medical-staff meetings. After viewing VL video, the project director will oversee hands-on training employing a simulated intubation scenario using Laerdal's Deluxe Difficult Airway Trainer. Providers will participate in four simulations, one standard, and one with difficult airway settings utilizing both VL and DL. Providers will complete a post-training survey to re-assess confidence and preparedness and the perceived value of VL training.

Program Evaluation Data Analysis

The effectiveness of this project will be evaluated on perceived confidence before and after the intervention of VL training including successful and unsuccessful simulated intubations. Medical record numbers will be collected; no other demographic information will be utilized. Information collected from chart review will be performed to assess the preintervention condition.

Cost-Benefit Analysis/Budget

Costs associated with this project include labor hours of family practice providers receiving the training and the anesthesia provider facilitating the training. The family practice providers are employed by Valdez Medical Clinic (VMC), and it is this agency that would absorb the hourly cost of providers receiving training. The anesthesia provider is employed by and receives compensation from PVMC.

There are minimal anticipated equipment costs for this project. The video laryngoscopes needed for the project were purchased three years prior to this project. PVMC has in its inventory two different brands of video laryngoscopes, a Glide Scope™ AVL Single-Use, and a McGrath™ MAC video laryngoscope. The annual maintenance on the Glidescope™ is $3672.00. There are no maintenance costs for the McGrath™ scopes as they are on a consumable agreement. PVMC has also purchased a difficult airway trainer and an emergent/difficult airway cart that will be beneficial for this project.

Training will take place during the regularly scheduled medical-staff meetings with a duration of approximately one hour. Simulation is estimated to be approximately two hours per provider. This training for the family practice providers is estimated to cost $2,466.00. The anesthesia provider time for administering the VL education and simulation estimated at $1,068.00 (see Appendix D). The estimated total cost of the project education and simulation including administration and depreciation cost is estimated at $3,760.50 (see table 2). The average reimbursement for emergency intubation is approximately $900.00. Subtracting the disposable cost used with the VL scope or the cleaning and processing necessary with a DL scope and the use of a rapid positioning intubation style (RPiS), the reimbursement is approximately $840.00. The hospital's (PVMC) cost for training and simulation could theoretically remunerate costs after five emergency intubation reimbursements (see table 3).

The costs of this project will benefit PVMC. Having non-expert providers better equipped to handle airway emergencies, could produce savings in not having to replace the anesthesia provider during periods of vacation and other absences. The family practice providers will benefit from the project by having increased knowledge and familiarity with VL intubation. Individuals living in or visiting the tourist town of Valdez would benefit, in the event that they or their family members need emergency airway care. Patients needing intubation would likely be intubated more promptly using fewer attempts, reducing patient injury and promoting recovery.

Timeline

After approval of the proposal defense in the early Spring 2020 semester, a Human Subjects Research determination will be sought by University of Alaska Anchorage (UAA) Institutional Review Board (IRB). The determination will then be submitted to Providence Health and Service's IRB. Approximately March of 2020, chart reviews will begin followed by the development of an instructional video designed to teach VL. In April 2020, it estimated that the preintervention survey would be delivered to the project population. Training and simulation will take place from April through July 2020. After the intervention, the postintervention survey will be provided in August 2020, followed by analysis and interpretation in September of 2020. The final re-write of the DNP project will take place in October of 2020. DNP defense will take place in November of 2020 (see Appendix E).

Ethical Considerations/Protection of Human Subjects

The function of the IRB is to initially affirm and periodically review, appropriate steps that must be followed to protect the rights and welfare of humans participating as subjects in research ("Institutional Review Boards," 1998). There will be no significant risks to humans participating in this project. Participating providers will benefit in increased familiarity and knowledge in the use of emergency intubations utilizing VL. Furthermore, patients in need of this type of care will benefit from the increased skill of their provider.

Data collected from chart reviews will not include any patient identifiers. Provider data will be anonymized. No demographic information will be collected, and project information will be stored on an encrypted flash drive in possession of the project director.

The Health Insurance Portability and Accountability Act (HIPAA) establishes the conditions under which protected health information may be used. This project will adhere to HIPPA standards in all aspects of its progression. Additionally, IRB requirements for Providence Health and Services and The University of Alaska Anchorage were sought and approved prior to initiation of the DNP project.

Conclusion

The clinical problem in this QI project addresses the successful first pass intubation and confidence of rural providers who are rarely called upon to perform emergency intubations when the single anesthesia provider is unavailable. DL is the traditional method of intubating patients in need of emergency airway care. The literature supports the use of VL for non-expert providers having a higher incidence of first pass of the endotracheal tube, with lower esophageal intubations. Faster response times and a decrease number of intubations attempts have also been shown to be prevalent with VL. The evidence suggested simulation training is effective in providers obtaining increased skill when using VL.

Chapter Five: Implementation Process and Procedures

Emergency airway care is a fundamental part of treating patients with cardiac, trauma, and other life-threatening emergencies. In rural areas where Critical Access Hospitals (CAH) are utilized, emergency airway care may be performed by less experienced or non-expert providers. This disparity in rural versus denser populated areas is associated with required guidelines from the Center for Medicare and Medicaid Services (CMS) for CAH. The guidelines from CMS deem anesthesia and surgical services optional in CAHs. These guidelines require only one Medical Doctor (MD) or Doctor of Osteopathic Medicine (DO) or advanced practice registered nurse (APRN) either be on-site or on-call and available within 30 minutes. In some remote areas, this criterion for response time is extended to 60 minutes (Rural Health Information Hub, 2019).

Less experienced providers often require more attempts at intubation. Multiple attempts while performing emergency intubation are associated with a higher incidence of adverse events, as compared to a single attempt (Sakles et al., 2013). Findings from a critical review of the literature show that video laryngoscopy (VL) increases the first-pass success of the endotracheal tube as compared to direct laryngoscopy (DL). The VL method is associated with faster intubation times and an improved view of glottic structures.

With the recent global novel Coronavirus Disease 2019 (COVID-19) pandemic, it is recommended to utilize VL as opposed to DL when intubating a COVID-19 suspected patient. VL allows the provider to perform intubation to minimize proximity to the patient. During this intubation, if the patient coughs or forcefully exhales in or around the endotracheal tube (ETT), the resulting air movement can aerosolize. This forceful air movement can make the virus transmitted via airborne as well as via droplet transmission (Anesthesia Patient Safety Foundation, 2020; Chavez, Long, Koyfman, & Liang, 2020; Samet, 2020).

Implementation Steps

To ensure consistent delivery of VL education and training, several videos were created to deliver pre-recorded video lectures for participants. This video was filmed using the equipment in inventory at the practice site. The pre-recorded videos were designated into a non-attached (separate monitor, e.g., Glidescope) and attached monitor (monitor on video laryngoscope, e.g., McGrath MAC) categories. The production of videos was part of a course through the Film and Performing Arts Program at the University of Alaska Fairbanks: FLPA 497, Medical Video Methodology. Production of the medical videos included script development, archival, visual research, production design, pre-production development planning, film production, post-production, and development of storyboard (see Appendix G).

With the possibility of dissemination of this video to other Alaskan CAHs, an introduction statement was inserted stating the credentials of who was presenting the education. The target audience for this VL lecture was noted to be non-expert providers who rarely perform intubation. A statement was also added, explaining that this education/training was to be used only by qualified, trained individuals who have been vetted by authorized healthcare entities.

Both VL videos, (attached monitor, and non-attached monitor) start with similar techniques and preparations. Each video instructs the learner to place the patient's head in the sniffing position, (an elevation of the head three to seven centimeters, which includes an atlanto-occipital extension). The sniffing position is contraindicated in patients suspected of cervical spine injury. In the presence of suspected or actual cervical injury the learner is instructed to open the patient's mouth with a finger-scissor technique. This is performed with the right hand by flexing the thumb and middle finger in an opposing manner on the upper and lower dentition (Peterson, Ginglen, Valenzuela, Kolikof, & Guzman, 2020).

The non-attached VL instruction demonstrated the 4-step intubation technique, which is recommended by the Glidescope manufacturer (Verathon, 2019). This video begins with an explanation of the non-attached video laryngoscope functionality**,** including the power button, recording features**,** and battery indicator. A demonstration of the application of the disposable blades is included in the videos, which explains estimating for patient size and gender.

Non-attached monitor with 4-step technique is demonstrated in the following steps:

1. Look in the Mouth: With the video laryngoscope blade in your left hand, introduce it into the midline of the oropharynx.
2. Look at the Screen: Identify the epiglottis (epiglottoscopy), and then manipulate the blade to obtain the best glottic view.
3. Look in the Mouth: Carefully guide the distal tip of the tube into position near the tip of the blade.
4. Look at the Screen: Complete the intubation, gently rotating, or angling the endotracheal tube aw needed to redirect it.

The attached monitor technique video is demonstrated in the following steps:

1. Insert the VL device in the right side of the mouth and move the blade to the midline, staying opposed to the dorsal surface of the tongue.
2. Advance and rotate the blade around the tongue, staying in the midline, while watching on the video screen to identify key midline airway landmarks (uvula and tip of the epiglottis; epiglottoscopy).
3. Advance until the blade rests in the vallecula.
4. Gently tilt the blade and cranially bring the vocal cords into view on the screen. Do not place the device too close to the glottic inlet as this impedes tube passage.

Processes for Implementation

Since the implementation of the project took place during the COVID-19 pandemic, the pre and post-survey Likert scales were delivered via a sharable link to a Google drive. The pre-recorded training video was delivered via an unlisted YouTube link included in the email with the link for the pre-survey. Once the pre-survey had been completed and returned, individual training began. Providers participated in four simulations, each utilizing both DL and VL. This included one standard intubation simulation and one with a simulated difficult airway for each type of laryngoscope. Participants were educated on the Modified Cormack Lehane classification, and used this scale to describe the laryngeal view during all intubation simulation. Additional training information on airway assessment, rapid sequence intubation (RSI), induction medications, and cricothyrotomy was presented. Training took take place at PVMC and involved providers associated with this institution. Before beginning simulations, providers were familiar with prerequisite intubation information (see Appendix H).

Barriers and Challenges

Challenges to the intended implementation of this project included the national pandemic. The education was initially planned to be delivered during a regularly scheduled in-person medical-staff meeting, however, that meeting changed to an online format. Training and simulation were conducted with the used of recommended personal protection equipment (PPE). Providers maintained social distancing of six feet whenever possible.

Barriers included an inability to access a patient's chart as directed by the Providence Institutional Review Board. Initially it was planned to perform a chart review prior to the project to determine if the provider was able to intubate the patient, what type of laryngoscopy was used, and how many attempts were needed. Providence Health and Services does not allow students access to protected health information. Even though I am an employee of Providence Health and Services, this project is not being initiated via this institution, and my status remains that of a student. However, this information is most likely not charted due to the inexperience of the scribe. In this rural CAH, emergency cases where endotracheal intubation is taking place, licensed personnel are performing care of the patient while ancillary employees are enlisted to scribe. This oversight in documentation of intubations has been addressed by the institution as a result of this DNP project. The utility of accessing intubations after the VL training is potentially of low value because of low occurrence of intubations. The other barrier related to COVID-19 patients, and current recommendations is that the most experienced intubation provider should perform the intubation, which would be the anesthesia provider.

Scheduling time for training with physicians became a challenge, as everyone had extra duties and committees due to the COVID-19 pandemic. Several training sessions got postponed and rescheduled because of urgent hospital priorities. One training, in particular, was delayed for the provider to quarantine for fourteen days after a possible exposure with a mask failure.

Conclusion

This project comes at an auspicious time. There has been a rapid spread of COVID-19, which has developed into a global pandemic. Emergency endotracheal intubations have increased proportionally with the onset of the coronavirus. Intubating patients with COVID-19 is a high-risk procedure due to the aerosolization of respiratory droplets. VL is preferred to (DL) to increase the physical distance between the provider performing intubation and the patient with the virus (Chavez et al., 2020).

A review of the literature suggests video laryngoscopy (VL) increases first-pass ETT success, improves both intubation times and view of the glottic structures. Less experienced providers intubating patients at CAH, as well as experienced providers, are recommended to utilize VL in suspected COVID-19 patients. This project endeavors to equip rural physicians who seldom are tasked with emergency endotracheal intubation with the recommended and most suitable intubation technique.

Chapter Six: Evaluation and Outcomes of Practice Change

The purpose of this DNP project was to determine if training and simulation in video laryngoscopy (VL) would improve the confidence of non-expert airway providers performing emergency endotracheal intubation. Typically, intubation is not a routinely practiced skill by providers furnishing medical coverage at a Critical Access Hospital (CAH). When this skill is performed, it usually is during high-stress conditions with a critically ill patient.

Ten (N=10) provider participants were involved in the quality improvement (QI) project, and all were associated with a CAH. There were seven females and three males. Seven participants were Medical Doctors (MD) and three were Advanced Practice Registered Nurses (APRN). The survey was provided in English only as all participants were English-speaking. The pre-survey was given in both electronic and paper form. The post-survey was given to the participants directly after QI training on paper.

Statistical Methods

Frequency and percentage statistics were used to describe the successful or unsuccessful intubation of the simulated patients for both easy and hard DL and VL cases. The Likert-type response distributions for the pre-implementation and post-implementation questions were checked for the statistical assumption of normality using skewness and kurtosis statistics. If both statistics were below an absolute value of 2.0, then the assumption was met for that distribution. When the assumption was met for both distributions, repeated-measures *t*-tests were used to compare the pre-implementation and post-implementation response distributions. Means and standard deviations were reported and interpreted for the *t*-test analyses. Statistical significance was assumed at an alpha value of 0.05. All analyses were performed using SPSS Version 26 (Armonk, NY: IBM Corp.).

Outcome Measures

Outcome measures for this project included pre and post-implementation comparison of confidence for providers of emergency airway care using both direct and video laryngoscopy to achieve emergency endotracheal (ETT) at a CAH. Data was collected over a period of 15 weeks using pre-and post-survey responses before and after training and simulation of laryngoscopy. In this quality improvement project, both the pre-survey and post-survey (Appendix F) assessed types of laryngoscopes used at the practice site, confidence with achieving laryngoscopy for intubation, confidence achieving first-pass of the ETT, and improvement of the glottic view.

Survey data. The pre and post-surveys consisted of seven statements. These statements included a demographic question where participants checked a box ranking their experience. The pre and post surveys also used a five-point Likert scale for an additional six questions. The post-survey included additional open-ended questions asking participants to describe the QI training. The narrative data resulting from these open-ended items were reviewed for common themes.

Statistical Results

The assumption of normality was met for each pre-implementation and post-implementation distribution of Likert-type responses. Repeated-measures *t*-tests found statistically significant increases in responses across time for Statement two (p = .01), Statement three (p = .03), Statement four (p = .02), Statement five (p = .005), Statement six (p = .044), and Statement seven (p = .028). The means and standard deviations for the t-test analyses are presented in Table 4. The frequencies of successful simulated intubations are presented in Table 5. Participant's view of glottis based on the modified Cormack Lehane scale is presented in Table 6.

Statement one. The first statement asked providers to identify their years of experience in emergency care. The categories ranged from one to ten years, eleven to twenty years, twenty-one to thirty, and thirty-one to greater than forty or more years of experience. Sixty percent of the participants had one to ten years of experience. Twenty percent of participants had eleven to twenty years of experience. One participant (10%) selected the twenty-one to thirty categories, and one participant (10%) chose the thirty-one to greater than forty years of experience group.

Statement two. I am aware of the make and model of VL available at PVMC? Pre-implementation: four providers (40%); answered strongly disagree, two (20%); answered neutral, two (20%) answered agree, and the remaining two providers (20%) answered strongly agree. Post-implementation, one out of ten answered (neutral), 10%, two out of ten answered (agree), 20%, and seven out of ten answered (strongly agree) 70%. The difference between pre and post-implementation responses were compared using repeated measures *t*-test resulting in a statistically significant increase ($p = .01$) in knowledge of make and model of equipment across time for this statement (see Table 4).

Statement three. Rate your confidence using DL. Pre-implementation: two of the ten providers answered (not at all confident), 20%; two of the ten answered (not very confident), 20%; four of the ten answered (neutral), 40%; and two of the ten answered (somewhat confident), 20%. Post-implementation four out of ten answered (neutral), 40%; and six of the ten answered (somewhat confident), 60%. The pre and post implementation difference of statement three also increased, $p = .03$ (see Table 4).

Statement four. Rate your confidence using VL. Pre-implementation: two of the ten providers answered (not at all confident), 20%; one of the ten answered (not very confident), 10%; two out of ten answered (neutral), 20%; four of the ten answered (somewhat confident), 40%; and one of the ten answered (very confident), 10%. Post-implementation four out of ten answered (somewhat confident), 40%; and six of the ten answered (very confident), 60%. Statement four had an increase between pre and post-implementation, $p = .022$ (see Table 4).

Statement five. Rate your confidence with first-pass intubation with either DL or VL (on patients evaluated to be low risk for difficult airway). This statement asks the provider to rate confidence with intubating the patient on the very first attempt. Pre-implementation responses included: two of the ten providers answered (not at all confident), 20%; two of the ten answered (not very confident), 20%; three of the ten answered (neutral), 30%; and three of the ten answered (somewhat confident), 30%. After implementation, statement five had significant increases ($p = .005$), in responses: eight out of ten answered (somewhat confident), 80%; and two of the ten answered (very confident), 20%; (see Table 4).

Statement six. I am confident that VL is associated with an improved glottic view as compared with DL. Pre-implementation: two of the ten providers answered (not at all confident), 20%; one of the ten answered (neutral), 10%; two of the ten answered (somewhat confident), 20%; and five out of ten answered (very confident), 50%. In the post-implementation results all ten participants chose (very confident), 100%; with a resulting $p = .044$ for statement six (see Table 4).

Statement seven. I am confident that VL is associated with a higher first pass of the ETT as compared to VL. Pre-implementation: two of the ten providers answered (not at all confident), 20%; one of the ten answered (neutral), 10%; three of the ten answered (somewhat confident), 30%; and four of the ten answered (very confident), 40%. Post-implementation results were ten of the ten participants choosing (very confident), 100%; (N=10) with a resulting $p = .028$ for statement seven (see Table 4).

Table 4.

Descriptive Statistics for Repeated-Measures *t*-tests

Question	Pre-intervention	Post-intervention	*p*-value
Statement 2 (awareness of VL equipment)	2.8 (1.7)	4.6 (0.7)	.01
Statement 3 (confidence with DL)	2.6 (1.1)	3.6 (0.5)	.03
Statement 4 (confidence with VL)	3.1 (1.4)	4.6 (0.5)	.02
Statement 5 (confidence with first pass of ETT)	2.7 (1.2)	4.2 (0.4)	.005
Statement 6 (VL offers improved glottic view as compared to DL)	3.8 (1.6)	5.0 (0.0)	.04
Statement 7 (VL is associated with higher first pass of ETT as compared to DL)	3.8 (1.6)	5.0 (0.0)	.03

Results of Simulation

Participants viewed the educational prerecorded lecture before arriving for simulation. The simulations were conducted at the practice site on an individual basis, using equipment available at the CAH. After viewing an educational lecture on performing VL, participants practiced both direct (DL) and video (VL) intubations on a Laerdal Difficult Airway Simulator with the project lead. Nine of the ten participants (90%) were able to intubate the simulator in normal or easy mode successfully using DL. None (0%) of the participants were successful in attempting DL intubation with the simulator in difficult airway mode. When using VL all participants (100%) successfully intubated the simulator in normal or easy mode as well as difficult mode in a single attempt (see table 5).

Table 5.

Categorical Variables (Intubation simulation)

Simulation	**Level**	**Frequency (%)**
Easy/ Normal	Not intubated	1 (10.0%)
airway DL	Intubated	9 (90.0%)
Difficult/Hard	Not intubated	10 (100.0%)
airway DL	Intubated	0 (0.0%)
Easy VL/	Not intubated	0 (0.0%)
Normal airway	Intubated	10 (100.0%)
DL		
Difficult/Hard	Not intubated	0 (0.0%)
airway VL	Intubated	10 (100.0%)

Participants were asked to rate the laryngeal view they were able to achieve using the modified Cormack Lehane scale (MCL); (Appendix H). The MCL scale has been validated in several studies and has been reported to have good inter-physician and intra-physician reliabilities (Levitan et al., 1998). The MML has five grades: grade (I) which depicts a full view of the glottic; grade (IIa) shows only a partial view of the glottis while grade (IIb) shows only the arytenoids or posterior part of vocal cords that are only just visible; grade (III) is only a view of the epiglottis is visible and grade (IV) neither the glottis nor the epiglottis is visible (Yentis & Lee, 1998). Using the MML scale, participants recorded their views during each of the four simulations. Consistently, the VL simulations, both easy and difficult, had lower MCL scales, which translated to better views compared to DL (see Table 6).

Table 6.

Categorical Variables (View of glottis based on modified Cormack Lehane scale)

Simulation	Level	Frequency (%)
DL: MCL Scale	2a	7 (70.0%)
(easy)	2b	2 (20.0%)
	3	1 (10.0%)
DL: MCL Scale	3	1 (10.0%)
(hard)	4	9 (90.0%)
VL: MCL Scale	1	8 (80.0%)
(easy)	2a	2 (20.0%)
VL: MCL Scale	1	1 (10.0%)
(hard)	2a	1 (10.0%)
	2b	8 (80.0%)

As part of the post-implementation survey, participants were asked several open-ended questions regarding the value of this QI training. Data from open-ended survey questions were reviewed, coded, and categorized. The providers were asked to recall pre-implementation confidence and skill level and reflect on the same post-training perception. This project utilized content analysis to conceptualize the text from the open-ended questions and summarized common responses revealed in the narrative data. The resulting narrative data were analyzed utilizing NVivo 12 (released in March 2020).

All participants (10/10) reported increased intubation-related confidence and/or skills after completing VL training. Participants described a range of items learned during VL training. Most often, participants reported expanding their knowledge about intubation and intubation-related techniques (e.g. beer tap/slot machine maneuver, LMA, Fastrach ETT, and RSI, among others.). Some participants mentioned gaining an increased understanding of existing resources, such as *"better knowledge of equipment available at PVMC,"* whereas others focused their comments on specific benefits of VL use; *"improved field of vision with VL."*

After discussing the range of items, they learned during training, participants were asked to comment on how the view obtained with VL compared to the view with DL. Participants clearly expressed their preference for the view obtained with VL. One commented there was a *"night and day difference"* between VL and DL. Others described the view with VL as *"superior"* and *"easier to obtain".* Of the six (6) participants who explained why they believed the view obtained with VL was preferable, two (2) said landmarks were easier to view, two (2) that it helped visualization with difficult airways, one (1) that less arm strength was necessary to obtain an improved view, and one (1) that it *"took a MCL scale of 2b-3 and made it into a 1-2a [meaning] more successful intubations."*

Participants (10/10) described increased post-training confidence in obtaining a first pass intubation, especially with the use of VL. One participant explained; *"I am so much more* *confident with success of the first pass intubation using VL."* Another participant said their confidence level went from a *"0/10 up to a 7/10."*

One participant stated that intubation was not an "*overlearned skill*" in her discipline. Although she had never used VL in her forty years of practice, she would be using it because of increased confidence and current recommendations to use VL due to the COVID-19 pandemic. Another participant stated, "*I think all providers coming to practice here should go through this training*."

While not all participants provided information on their previous training or experience with VL prior to the current training, all (10/10) reported improved knowledge about VL post-training. Post-training, participants were uniformly positive about use of VL to ensure successful intubations, especially in *"difficult"* cases.

Although not asked to identify benefits of the VL training more generally, several participants volunteered comments. One participant believed the training would *"decrease traumatic intubations"* and that it was a *"great project that is timely in COVID and can really change rural health disparities."* Another participant felt the training should be continued—and expanded—to include additional staff; *"repeating [the training] at regular intervals would do a lot for improving airway skills of all providers at our facility. Involving the nurses in the training would be helpful as well for familiarity with equipment."*

Conclusion

This project aimed to develop evidence-based training and simulation directed at improving emergency airway care at a CAH. Improving intubation is vital in these institutions as some do not have expert airway providers available at all times. This evidence-based project showed statistically significant increases in confidence (p = .03) among providers who do not often perform endotracheal intubation. This educational QI project demonstrated an overall higher success rate of endotracheal intubation with VL compared to DL. Providers' view of the glottic opening was better with VL compared to DL (p = .04). The project demonstrated that providers felt more confident with VL intubation after the QI training (p = .02).

Chapter 7: Implications for Nursing Practice

The Association of Colleges of Nursing (AACN) in 2006 established eight Doctor of Nursing Practice (DNP) essentials addressing the foundational competencies that are core to all advanced nursing practice roles. The DNP Essentials do not have one definitive focal point; rather, they incorporate the gamut of advanced nursing skills and leadership qualities required to demonstrate improved healthcare outcomes. The DNP essentials give the nurse the tools and competencies necessary engage in their role at the highest level. This chapter will discuss the importance of each DNP Essential and how each essential applies to this QI project.

DNP Essential I: Scientific Underpinnings for Practice

Essential I: Scientific Underpinnings for Practice was achieved through the application of both nursing and medical theories and models from anesthesiology, emergency care, and critical care. For providers practicing at a CAH, providing intubation services was rare. Most practitioners received traditional education on the direct laryngoscope. After a critical review of the evidence and the development of an evidence-based training series, the DNP graduate was able to educate novice intubators on intubation with a video laryngoscope. The educational videos were created after a critical review of the literature. These videos incorporated device specific instructions from VL manufactures, techniques in stylet use, and state of the science in intubation care. These lectures were produced to improve tracheal intubation in non-expert providers to improve patient outcomes. The actions and advanced strategies such optimal positioning for successful intubation, complications associated with intubation and confirmation techniques of successful endotracheal intubation care were developed and delivered to rural providers. This included the use and demonstration of VL, and ancillary techniques associated with intubation, as well as VL specific stylet techniques. This VL training is accordant with current recommendations for intubation with patients with COVID-19 ("Information on COVID-19 Treatment, Prevention and Research", 2020).

DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking.

The second DNP essential focuses on the significance of organizational and nursing leadership skills to improve patient care and outcomes. Leadership involves recognizing health priorities, eliminating health disparities, and promoting patient safety and excellence in practice. This was accomplished in the evaluation and development of a QI training for rural specific patient population needs. The DNP graduate emphasized this essential by assimilating the science and key skills of emergency airway care along with the network of regional approvals through UAA and Providence Health and Services IRB. At a local level, the DNP graduate informed the stakeholders of the need and benefits of the QI project. Approval and resources were acquired to initiate the DNP project.

Development of the QI project targeted providers who rarely perform emergency airway care, provisioning them with training and optimization in the use of current emergency airway equipment. Organizational and systems leadership are critical to improving patient and healthcare outcomes. In participating in the development, promotion of evidence-based interventions, and educational material, the DNP graduate participated in supporting patient safety and eliminating health disparities associated with rural healthcare.

DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

DNP Essential III recognizes the need for scholarly and analytical methods in critically appraising existing literature and other information to determine and implement the best evidence for practice. The AACN (2006) indicates that key skills of the DNP graduate should be development of clinical practice guidelines, designing evidence-based interventions, evaluating practice outcomes, quality improvement techniques as well as promoting safe, effective and timely patient-centered care.

The DNP graduate designed, directed, and evaluated a quality improvement project focused on improving the confidence and comfort of providers at a CAH who have the responsibility of providing emergency airway intubation. Laryngoscopy is a high consequence skill they are rarely called on to perform. A review of existing literature and benchmark intubation videos were critically appraised to determine the best evidence for practice. Acting as a practice/specialist consultant, the provider presented the dissemination of findings from evidence-based practice and research to improve rural healthcare outcomes.

DNP Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

DNP Essential IV focuses on the importance of information systems/technology in patient care to implement quality improvement initiatives and support practice and how this technology, when appropriately applied, can improve and revolutionize health care. Film making technology was used to create video lectures for two different types of video laryngoscopes. These lectures were distributed to participants via YouTube. The DNP graduate used simulation technology to demonstrate and improve laryngoscopy techniques. This simulation technology gave participants a side by side comparison of DL and VL technology

Using technology via informational/educational pre-recorded video lecture, critical information, and technical skills delivered to local CAH providers improved confidence levels in performing emergency airway care. This patient care information could potentially be disseminated throughout Alaska's Critical Access Hospitals.

DNP Essential V: Health Care Policy for Advocacy in Health Care

Health policy influences multiple care delivery issues, health disparities, access to care, and many other issues concerned with the action and distribution of health care. The DNP graduates are prepared to design, influence, educate, and implement health care policies that frame practice. The DNP Essential V: Health Care Policy for Advocacy in Health Care was utilized when the DNP graduate educated family practice physicians and other disciplines on emergency airway care policy currently used at the practice site. The existing policy was also addressed regarding documentation of the number of intubation attempts and what type of laryngoscope was used.

DNP Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

Essential VI recognizes the preparation and collaboration among professionals in achieving improved health outcomes. The DNP program graduate employs consultative and leadership skills with intraprofessional and interprofessional disciplines to create change in health care and complex healthcare delivery systems. This Essential (VI) was addressed in this project during the development of pre-recorded intubation lecture videos for multi-disciplinary emergency airway care providers. The DNP graduate exhibited effective communication, collaboration, and leadership skills while delivering emergency airway care knowledge and training. This scholarly project involved multiple inter-professional teams' which collaborated in the knowledge and skills essential in completing this undertaking. Anesthesia providers gave insight into VL and DL concepts. Family Medicine and Nurse Practitioners gave input regarding emergency department care expectations and previous training and current skills surrounding intubation. Nursing gave insight and recommendations to collaborative work in performing emergency airway care at the practice site. A Department of Theater and film professor gave guidance in film production on developing intubation medical training videos. Instructional Design and Information Technology were involved in video production. This education, training, and simulation were delivered to inter-professional disciplines to improve patient outcomes at a CAH.

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health

Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health suggests that clinical prevention is defined as health promotion and risk reduction/illness prevention for individuals and families. During this project, evidence-based educational script, video lectures, training, and simulations were developed and used by providers who have the responsibility of emergency intubation but who infrequently perform the skill. This project evaluated care delivery methods of intubation at a CAH and provided evidence-based training utilizing VL, which increased the provider's confidence with emergency intubation. This QI project promotes population health and reduces the risk of mortality by ensuring a competence and confidence in rural providers responsible for emergency intubations.

Essential VIII: Advanced Nursing Practice

Essential VIII recognizes the DNP graduate's competency and knowledge and describes the role of the DNP-prepared nurse in improving health care. In this DNP project, the design, implementation, and development of an intervention that improved competence and confidence of providers of rural CAH, furnishing emergency airway care. This QI project was conducted in an interprofessional setting utilizing evidence-based care that has the potential to improve patient outcomes (American Association of Colleges of Nursing, 2006).

Conclusion

This chapter has reviewed the DNP Essentials and described how they were met through this QI project. The DNP Essentials reflect foundational skills for advanced practice nurses, and each was used during the development and implementation of this project. These Essentials provided the framework for this project aimed at increasing the competence and confidence of CAH providers of emergency airway care utilizing VL instead of the traditional use of DL.

Chapter 8: Summary and Conclusion

This DNP project focused on improving emergency airway care at a CAH. In certain situations, the care you receive in rural locations can differ from larger metropolitan areas. Rural hospitals tend to have fewer specialty disciplines and less healthcare technology (Johnston, Wen, Joynt Maddox, 2019). Providers at rural locations typically have limited exposure to providing airway care and less opportunity to practice intubation skills. These less experienced providers often take a longer time and require more attempts to perform intubation skills. Multiple attempts and increased time in intubating the airway are associated with higher morbidity and mortality (Sakles, et al., 2013).

This project's initial motivation was an awareness of these difficulties by the project lead when called to assist or perform intubation previously attempted by typical providers of a CAH. Before this QI project, most providers at this CAH only had exposure to laryngoscopy with a direct laryngoscope. While most were aware of video laryngoscopes, they had never received training and were unsure how to use VL to perform intubation.

Key Points

The purpose of this DNP project was to increase the confidence and competence of providers responsible for emergency airway care at a CAH. Another goal of this project was to equip providers with knowledge and skill to decrease intubation attempts to within two. A critical review of the literature advised that VL is correlated with an improved view of the glottic area, faster intubation times, and a greater likelihood of passing the ETT correctly on the first intubation attempt (Arulkumaran, 2018; Baek, 2018; Toker et al., 2019). VL is also associated with increased confidences with emergency intubation. (Hypes et al., 2016).

Lippet's change theory (1958) provided a framework that guided the development, implementation, and evaluation of this DNP project. The organizational framework worked well for this project because it emphasizes using a change agent and parallels the nursing process. As the only anesthesia provider, the project lead was able to act as the change agent, monitoring the organization's motivation and transformation to VL.

Participants completed a pre-survey utilizing a Likert scale that assessed provider's knowledge of types of laryngoscopes used at CAH site, confidence with achieving laryngoscopy for intubation for both DL and VL, confidence achieving first-pass of the ETT, and improvement of the glottic view. Participants viewed pre-recorded video lectures for two different video laryngoscopes. The lectures gave insight to the intubation process using VL. During training and simulation, providers were given additional information regarding airway assessment, rapid sequence induction techniques, and medications. Before the simulation, providers were able to practice DL and VL intubations with guidance from the project lead. Participants participated individually in four separate simulations, results of intubation attempt and best view obtained were recorded for each simulation. After simulation, participants completed a post-survey containing the same Likert scale, with the addition of open-ended questions.

Conclusion

Following the education and simulation all participants were able to intubate both normal and difficult intubations using VL within one attempt (100%). Better laryngeal views were reported using VL as opposed to DL using the modified Cormack-Lehane scale. When responding to the post-survey, participants reported an increased confidence (p = .022) when using VL to intubate patients, increased confidence with first pass of the ETT (p = .028) and a better view of the glottic area with VL rather than DL (p = .044). Post implementation providers had an increased knowledge of the type of video laryngoscope at practice site (p = .01).

Several themes were extrapolated from participants' open-ended questions. All participants expressed increased confidence with intubation (particularly with VL) as a result of training and simulation. All participants conveyed increased assurance in being better prepared to intubate patients on the first attempt. Several providers noted that VL was physically easier than DL, not requiring as much use of strength. All participants noted that VL offered a superior view as that of DL.

The providers have requested this QI airway training to be ongoing and offered to all visiting students and residents. The providers of this CAH are adjunct faculty for Dartmouth Geisel School of Medicine, located in Hanover, New Hampshire. A family medicine clerkship is offered to students of this medical school in Valdez, Alaska. Students work with full-spectrum family physicians, including inpatient experiences (Geisel School of Medicine at Dartmouth, 2020). In addition to working with medical students, providers at this CAH also host residents in the Alaska Family Medicine Residency. Currently, plans are being made with stakeholders to provide this QI training to these medical students and residents as part of their pedagogical experience at PVMC.

Recommendations for further education would include CAH providers participating in a quarterly or semi-annual review of laryngoscopy techniques. Expanding this airway QI training program to include pediatrics and neonatal intubations using VL would be beneficial, as this CAH receives all ages of patients. Developing and recommending airway guidelines for the practice management of airways involved in trauma would be beneficial as this CAH is designated a level four trauma center.

Future research could include successful intubation rates among the different video laryngoscopes available at this CAH. Several providers indicated a preference for the attached screen laryngoscope, while others preferred the non-attached screen. The non-attached screen was utilized due to the current recommendations associated with the COVID-19 precautions. The view of the laryngoscope with the screen attached is more inline while intubating and has a similar DL feel. Another area of needed research should focus on the disparity of airway care in rural areas as opposed to that of denser populated areas. According to the American Academy of Family Physicians (AAFP), seventeen percent of their membership is considered rural physicians. Of those rural physicians, forty-seven percent practice emergency care. When extrapolated, approximately 8,100 non-expert physicians in the United States may have the responsibility of providing emergency intubation with limited experience in endotracheal intubation. The number would be larger when the number of nurse practitioners and physician assistants who cover rural and CAH's emergency departments are added (Banks, Wingrove, Petterson & Klink, 2020).

Practice implications as a result of this project may include requesting visiting locum tenens providers working at CAH to participate in airway training. PVMC administration and members of medical staff are requesting that this training be given to the nursing staff. Although the nursing staff does not intubate patients, they are directly involved in all aspects of emergency airway care and assisting with intubation. Having both the medical and nursing staff trained in this emergency airway project will provide for more cohesive teamwork when confronted with patients needing emergency intubation.

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Appendix A

Evidence Table

APA Citation	Purpose	Description of the sample	Research design type and level of evidence	Measurement tools	Strengths	Limitations	Findings	Implications
Aghamohammadi et al. (2015)	research was conducted to assess the effects of DL and VL training on the success rate of tracheal intubation by low-skill students	*N*=50 undergraduate students of anesthesiology with a mean age of 21.06 ± 0.42 years.	RCT **LOE**: Level 2	SPSS software version 12, using the chi-square and Fisher's exact procedure and *t*-test for the qualitative and quantitative data.	Participants did not have considerable laryngoscopy experience.	Did not discuss airway difficulty and intubation complications were not recorded.	A clear distinction was noted between the 2 teams based on the required time for laryngoscopy and intubation in all stages, the VL group was significantly lower compared to DL. With the more challenging intubation, the VL group were able to significantly reduce the required time for intubation ($p < 0.0001$).	VL proved significantly faster than direct laryngoscopy.
Ambrosia et al. (2014)	To determine difference intubation success and successful intubation times between novice physicians using DL and VL.	*N*=40 first year residences of different disciplines who had fewer than 5 live intubations.	RCT **LOE**: Level 2	A visual analog scale (VAS) was administered, evaluating comfort level with the use of both laryngoscopes as well as the participant's confidence. Categorical data regarding success or failure of intubation were compared between study arms using the Fisher exact test. VAS scores for time to intubation and confidence in the ability to intubate were compared using a 1-way analysis of variance.	Participants were novice providers from different disciplines. Study used difficult airway and cervical spine immobilization in trial.	Limitations of the simulation included difficulties in replicating the nuances involved with endotracheal intubation as well as the lack of anatomic fidelity associated with manikins. In terms of endotracheal intubation training, nuances not addressed even in the setting of cervical spine immobilization include tongue manipulation, depth of the laryngoscope tip manipulating the laryngeal view, and differential movements during rapid sequence intubation.	The Macintosh laryngoscope group (n = 19) had an intubation success rate of 47.4%. The video-assisted laryngoscope group (*n* = 21) demonstrated a significantly higher rate success rate of 100% (P \ .0001). The mean difference in success rate between groups was 52.6% (95% confidence interval [CI]: 30.0%, 75.3%).	This study demonstrates that providers with little to no prior intubation experience showed significantly higher intubation success with lower intubation times using VL.

Arulkumaran et al. (2018)	Primary purpose: determine between DI and VL which had higher FAI	*N*=32 out of 78 (studies included 15,064 intubations) reported the rate of FAI Setting: ED, ICU Attrition: NR	SR & MA **LOE** Level 1	Mantele Haenszel model Inverse-variance	*determined FAI in variety of settings outside of the operating room. *different levels of experience represented	*study did not differentiate intubation times *no data presented on view of glottis between DL & VL	*There was greater first-attempt at intubation with VL compared with DL amongst novice/trainee clinicians [OR.1.95 (1.45e2.64); *p*<0.001]) *VL compared with DL was associated with fewer esophageal intubations [OR.0.32 (0.14e0.70); P.0.003], but more arterial hypotension[OR.1.49 (1.00e2.23); P.0.05]	*having a definitive method of laryngoscopy will improve proficiency
Baek, et al. (2018)	To investigate which laryngoscopy mode is associated with higher first attempt intubation success in a general ward	*N*=958 patients Setting: tertiary academic hospital Attrition: NR	Retrospective. **LOE**: Level 3	multivariate logistic regression analyses	Includes airway classification information (i.e Cormack-Lehane classification system) *addressed pharmacological adjuncts to intubation	***study included data with supraglottic airways and elastic bougies *the number of intubation attempts was significantly lower in the VL group	*FAI success rate was higher with VL (79%; 391/493) than with DL (59%; 273/465, p < 0.001) *FAI success rate was higher among experienced operators (83%; 266/319) than among inexperienced operators (62%; 398/639, *p*< 0.001	this study had non-anesthesia novice clinicians similar to current practice
Berg et al (2009)	This study demonstrates that rapid training for intubation using VL can be accomplished for novice military healthcare personnel.	*N*=50 Subjects enrolled and 7 were excluded from analysis due to incomplete data. *n*=43 subjects completed the study, 34 novices and 9 self-reported non-novices.	RCT **LOE**: Level 2	paired t-test	Random mix of providers with different experience in intubation including RNs, MDs, dentists, and veterinarians.	Relatively small sample size.	Performance metrics including time to intubation, intubation success or failure, and self-reported Cormack-Lehane visualization grade of the larynx (Figure 1) were recorded. DL versus VL performance was compared (*p* <0.0001) .	This study demonstrates that rapid training for intubation using VL can be accomplished for novice military healthcare personnel.

Griesdale et al. (2011)	This study compared VL to DL regarding the glottic view, successful first-attempt intubation, and time to intubation.	*N*= 17	SR & MA **LOE**: Level 1	Relative risk (RR) as the summary measure for dichotomous outcomes (glottic view and successful first intubation attempt) and the weighted mean difference (WMD); statistical heterogeneity using Cochran's Q statistic	The authors made distinctions between expert and non-expert users.	Marked heterogeneity was noted in endpoints that was only partially explained by subgroup analysis. Another limitation is the low number of studies that included nonexperts, which markedly limits the ability to evaluate the effect of VL in this important subgroup	Compared to direct laryngoscopy, VL is associated with improved glottic visualization ($p < 0.001$), particularly in studies that considered patients with potential or simulated difficult airways.	In non-expert intubation providers, VL had lower number of intubation attempts; faster times to successful intubation and improved glottic visualization.
Howard-Quijano et al. (2008)	To determine if video-assisted laryngoscopy improves the effectiveness of tracheal intubation training.	*N*=37 novice trainees attempted intubation on 222 patients. 70% of the subjects were third year medical students, 19% were fourth year medical students and 11% were non-anesthesia residents.	RCT **LOE**: Level 2	A logistic regression model with a random novice effect was used for binary outcomes to assess the impact of VL instruction.	The study included novice providers from various medical disciplines. Study done on actual patients. All trainees received feedback during the procedure from an attending anesthesiologist based on standard cues. Additionally, during the video-assisted part of the study, the supervising anesthesiologist incorporated feedback based on the video images obtained from the fibreoptic camera located in the laryngoscope.	Limitations to this study included inability to control the number of attending anesthesiologists who served as instructors. Maintaining a small pool of instructors was not feasible due to the use of two sites, varying work schedules and the logistics of patient selection.	During video-assisted instruction, novices were successful at 69% of their intubation attempts whereas those trained during the non-video-assisted portion were successful in 55% of their attempts (P1⁄40.04). Esophageal intubations occurred in 3% of video-assisted intubation attempts and in 17% of traditional attempts (P,0.01).	The improved rate of successful intubation and the decreased rate of esophageal intubation support the use of video laryngoscopy for tracheal intubation training.
Lascarrou et al. (2017)	determine whether VL increases the frequency of successful	*N*=371 Setting: 7 ICUs in France	RCT **LOE**: Level 2	Fisher exact test for qualitative data and the t test or	randomization sequence was generated by a statistician at the clinical research	Study assessed a single type of VL; which was a similar blade to DL; a	Orotracheal intubation: video laryngoscopy compared with direct	Participants were classified as non-experts; frequency of FAI failure was

	first-pass orotracheal intubation compared with DL in ICU patients	Attrition: NR		the Wilcoxon rank sum test for quantitative data as appropriate	unit who had no role in patient recruitment; In addition to electronic database monitoring, onsite monitoring was performed by a study nurse at each ICU to ensure the good quality and completeness of the study data.	hyperangulated blade may have produced different results; the majority of FAI were performed by inexperienced physicians and secondary attempts made by experts; Use of gum elastic bougie with VL and not DL; 2 case report forms lost	laryngoscopy did not improve first-pass orotracheal intubation rates The proportion of patients with successful first-pass intubation did not differ significantly between the video laryngoscopy and direct laryngoscopy groups (67.7%vs 70.3%; absolute difference, −2.5%[95%CI, −11.9%to 6.9%]; P = .60).	common among both interventions.
Lewis et al. (2016)	primary objective was to assess whether use of VL for tracheal intubation in adults reduces risks of complications and failure compared with DL	RCTs and quasi-randomized studies with adult patients undergoing laryngoscopy performed with a VL or DL in a clinical, emergency or out-of-hospital setting.	SR & MA **LOE** Level 1	Cochrane methodological procedures, including assessment of risk of bias. (Mantel-Haenszel (M-H) odds ratio (OR) .	Review included well rounded selection of studies including ongoing studies during the review.	It was not possible for researchers to mask the anesthetist to the type of laryngoscope used, and we believe that this could have compromised the quality of the evidence in favor of either type of laryngoscope; unable to always determine level of experience of provider performing intubation.	Statistically significantly fewer failed intubations were reported when a VL	VL may reduce the number of failed intubations, particularly among patients presenting with a difficult airway. They improve the glottic view and may reduce laryngeal and airway trauma.
Myatra et al. (2019)	video laryngoscopy was used as a teaching tool for novices performing tracheal intubation which resulted in greater first pass success in neonates and infants.	*N*=144 American Society of Anesthesiologists (ASA) grade I–II patients of day one to six months of age, requiring general anesthesia with tracheal intubation (TI) performed by 24	RCT **LOE**: Level 2	The primary outcome was the first attempt success rate, and the secondary outcomes were time to best view, time to intubation, ease of intubation and maneuvers used.	The strength of the study is the randomized cross-over design which helps nullify the effect of the differences in skills among the anesthesiologist.	The trainees were not blinded so there can always be a potential for bias; however, this is not possible to achieve in such a study. Only the C-MAC VL was tested, and therefore the results may not apply to other VLs.	The first attempt intubation success rate was significantly higher in the VL group when compared with the DL group (83.3% vs 44.4%). In addition, the time to obtain the best view, time for intubation and ease of intubation were significantly	The high intubation success rate and reduced complications with VL use justify its use for tracheal intubation in this vulnerable population, though the cost may be prohibitive and availability limited. The

		anesthesia trainees.				Each trainee had a limited number of intubations attempts with each method, and hence the transferability of skill could not be assessed.	better in the VL compared to the DL group, and the need for external laryngeal manipulations and the use of a stylet were higher in the DL group.	magnified view of the larynx available to instructor and the trainee makes it easier to provide guidance during intubation, which can help increase the intubation success and avoid complications, making VL an excellent teaching tool for neonates and infants.
Parmekar et al. (2017)	The purpose of this study was to test the hypothesis that trainees who are taught endotracheal intubation during simulation with the VL will have a higher success rate compared to peers taught with the conventional DL.	*N*=100 pediatric residents (48 randomized into VL group and 52 in DL group).	RCT **LOE**: Level 2	McNemar's test; Wilcoxon signed-rank test.	Dual crossover study of the two methods of laryngoscopy on trainee's success rates and intubation times.	Did not study the real-time feedback from a supervisor on intubation success. Unable to detect a difference in success between groups in clinical NRP scenarios.	VL increased the success of endotracheal intubation by pediatric residents in simulation, with skills transferrable to DL.	Simulation and VL training will improve non-expert providers intubation and help to increase skill with DL.
Rombey et al. (2018)	The purpose of this study was to determine whether VL is superior to DL for the emergency intubation of adults in the inpatient setting.	*N* = 1098 titles and abstracts.	SR & MA **LOE**: Level 1	Statistical analyses were carried out with the Review Manager software (RevMan, version 5.3). The effect sizes for dichotomous endpoints were expressed as odds ratios (OR; Mantel–Haenszel method) and	Strength of this review is its systematic, predetermined nature. Clinical heterogeneity among the studies as a result of different settings or use of different de-vices for video laryngoscopy was assessed in subgroup analyses.	Despite an extensive literature search, only a small number of relevant randomized controlled trials were found. No ongoing or not yet published studies were registered at ClinicalTrials.gov.	There was no difference in first-pass intubation success rate between video laryngoscopy and direct laryngoscopy (p = 0.14); however, the data point to superiority of video laryngoscopy (OR 0.72, 95% confidence interval [CI] [0.47; 1.12], n = 1173 (17–23), I2 = 49%).	Video laryngoscopy seems to reduce the number of intubations attempts and the rate of esophageal intubation, so its use in emergency airway management could potentially increase patient safety. Video laryngoscopy also tended to be superior to direct laryngoscopy in

				continuous endpoints as mean differences (MD; inverse variance method).				terms of first-pass intubation success rate.
Silverberg et al. (2015)	Patients undergoing urgent endotracheal intubation were randomized to either VL or DL.	Of 153 consecutive patients, *N*=117 met study criteria.	RCT **LOE**: Level 2	t-test chi square test; Mann - Whitney	Study was conducted on patients who required urgent or emergent intubation. Five patients who were recognized to have difficult airway were all successfully intubated with VL on first attempt.	Limitations include the subjective assessments of laryngeal view by fellows using the Cormack-Lehane system, an assessment with known deficits in reproducibility.	The rate of FAI success in VL group was 74% compared with 40% in the DL group (*p*< .01).	VL improves first-attempt success rate during urgent/emergent endotracheal intubations.
Toker et al. (2019)	compare the larynx visualization provided by the Macintosh DL and McGrath VL and the intubation time of patients	*N*=100 Setting: tertiary obstetrics and gynecology hospital Attrition: NR	RCT **LOE**: Level 2	Shapiro-Wilk test and Mann-Whitney U test	Patients were randomized using a sealed-envelope technique. Computer generated random numbers, and patients were randomly allocated to two groups in which they would receive intubation with either VL or DL.	this prospective randomized controlled study could not be conducted in a blinded fashion and the anesthesiologist in this study was experienced in airway management and using VLs, which might have influenced the results.	Time taken for Glottic view (s) DL (*n* = 50) 19.5±3.9 VL (*n* = 50) 17.7±4.4 *p*< 0.028 Time taken for Tracheal tube placement (s) DL (*N* = 50) 32.6±4.7 VL (N = 50) 29.8±5.1 *p*< .007 Time taken for Intubation time (s) DL (*n* = 50) 40.1±5.4 VL (*N* = 50) 34.7±5.2 *p*< 0.001	significantly lowered intubation time by use of the VL-McGrath is important in obstetrical practice
Vanderbilt et al. (2014)	A review of the literature was conducted to analyze the impact of simulation-based training for direct and video laryngoscopy (VL) skills for health care professionals and health care students.	*N* = 11 A total of 1,152 published manuscripts were identified to review. After application of inclusion and exclusion criteria, these manuscripts were eliminated to eleven.	SR & MA **LOE**: Level 1	Two authors read the literature and independently determined if the article should be included in the review based on the previously stated inclusion criteria. All differences with respect to inclusion of a study were resolved	Focus was on the published literature that examined the effectiveness of DL and VL with simulation-based training as the educational intervention.	There was a lack of descriptions of the data collection process and interventions of the included studies including lack of effect size.	VL allows for a higher success rate, faster response time, and a decrease in the number of attempts by health care students and health care professionals under the conditions based on the eleven studies reviewed.	Suggests that simulation-based training is one effective way to teach VL laryngoscopy skills.

				with unanimity as the final criterion.				

Appendix B

Syntheses Table

Studies	**Design**	**Sample**	**Outcome**	**Interventions**	**Intervention Present**
A	Randomized controlled trial	*N*=50	VL proved significantly faster than direct laryngoscopy.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	**X**
B	Randomized controlled trial	*N*=40 first year residences	providers with little to no prior intubation experience showed significantly higher intubation success with lower intubation times using VL.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	**X**
C	Systematic review & meta-analysis	*N*=32 studies	VL ↑ FAI as compared with DL	- VL provided higher rates of FAI	**X** **X**

		Age: NR	with non-expert providers	- ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X
D	Retrospective study	*N*=958 patients Age: ≥ 19	VL ↑ FAI as compared with DL	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X
E	Randomized controlled trial	*N*=50	study demonstrates training for intubation using VL can be effective for non-expert providers.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications	X

				-VL training ↑ intubation success	
F	Systematic review & meta-analysis	*N*=17 trials.	In non-expert intubation providers, VL had lower number of intubation attempts; faster times to successful intubation and improved glottic visualization.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	**X** **X** **X**
G	Randomized controlled trial	*N*=37 novice trainees attempted intubation	Novices where successful in VL (69%) as compared to DL (55%).	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	**X** **X** **X**
H	Randomized controlled trial	*N*=371 Age: ≥ 16	No difference among intubation techniques	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL.	X

				- ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	
I	Systematic review & meta-analysis	*N*=64	VL may reduce the number of failed intubations, improve the glottic view.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X
J	Randomized controlled trial	*N*=144	The first attempt intubation success rate was significantly higher in the VL group when compared with the DL	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X

K	Randomized controlled trial	*N*=100	VL increased the success of endotracheal intubation using simulation.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X
L	Systematic review & meta-analysis	*N* =1098 titles and abstracts.	Video laryngoscopy seems to reduce the number of intubations attempts and the rate of esophageal intubation.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X
M	Randomized controlled trial	*N*=117	VL improves first-attempt success rate.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL.	X

				- VL intubation associated complications -VL training ↑ intubation success	
N	Randomized controlled trial	*N*-100 patients Age 18 to 49	VL ↑ FAI as compared with DL	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X X
O	Systematic review & meta-analysis	*N* = 11	VL allows for a higher success rate, faster response time; Suggests that simulation-based training is effective way to teach VL skills.	- VL provided higher rates of FAI - ↓ intubation time with VL. - ↓ esophageal intubations with VL. - ↑ visualization of glottic area with VL. - VL intubation associated complications -VL training ↑ intubation success	X X X

A) Aghamohammadi et al. (2015); B) Ambrosia et al. (2014); C, Arulkumaran et al. (2018); D, Baek, et al. (2018); E, Berg et al (2009); F, Griesdale et al. (2011);
G, Howard-Quijano et al. (2008); H, Lascarrou et al. (2017; I, Lewis et al. (2016); J, Myatra et al. (2019); K, Parmekar et al. (2017); L, Rombey et al. (2018); M,Silverberg et al. (2015); N, Toker et al. (2019); O, Vanderbilt et al. (2014)

X, derivative of intervention; DL = Direct Laryngoscopy; FAI = First-Attempt Intubation; VL = Video Laryngoscopy

Appendix C

Summary of Evidence

Themes identified in literature review	Greater 1st pass of ETT; decrease number of attempts; higher success	Faster to time of intubation	Supports VL training for tracheal intubation	Decrease esophageal intubation	Improved glottic visualization	Improved safety
Supporting Studies	Ambrosia et al. (2014). Arulkumaran et al. (2018). Baek, et al. (2018). Howard-Quijano et al. (2008). Griesdale et al. (2011). Lewis et al. (2016). Myatra et al. (2019). Parmekar et al. (2017). Rombey et al. (2018). Vanderbilt et al. (2014).	Aghamohammadi et al. (2015). Ambrosia et al. (2014). Griesdale et al. (2011). Toker et al. (2019). Vanderbilt et al. (2014).	Berg et al. (2009). Howard-Quijano et al. (2008). Myatra et al. (2019). Vanderbilt et al. (2014).	Howard-Quijano et al. (2008). Myatra et al. (2019). Rombey et al. (2018).	Berg et al (2009). Griesdale et al. (2011). Lewis et al. (2016).	Rombey et al. (2018).
Level of evidence	(5) Systematic review & meta-analysis- **LOE**: Level 1 (4) Randomized controlled trial- **LOE**: Level 2 (1) Retrospective **LOE**: Level 3	(2) Systematic review & meta-analysis- **LOE**: Level 1 (3) Randomized controlled trial- **LOE**: Level 2	(1) Systematic review & meta-analysis- **LOE**: Level 1 (3) Randomized controlled trial- **LOE**: Level 2	(1) Systematic review & meta-analysis- **LOE**: Level 1 (2) Randomized controlled trial- **LOE**: Level 2	(2) Systematic review & meta-analysis- **LOE**: Level 1 (1) Randomized controlled trial- **LOE**: Level 2	(1) Systematic review & meta-analysis- **LOE**: Level 1

Appendix D

Costs

Table 1

Expenditures items & Agency center costs

Type of Expense	Cost	Agency cost center
*Average coverage of ED	$ 137.00/hr	PVMC
**Average cost of anesthesia provider	$ 89.00/hr.	PVMC
Cost of GlideScope™	$ 9995.00	PVMC
Preventive maintenance for Glidescope™	$3,672.00	PVMC
Cost of McGrath™ VL scope	$ 1900.00	PVMC
Disposables for VL scopes	$ 18.00 each	PVMC
Labor for processing DL scope	$ 20.00	PVMC
Difficult airway trainer (DAT)	$ 2530.00	PVMC
Depreciation estimated (5%) on use of DAT	$ 126.50	PVMC
Rapid positioning intubation stylet	$ 40.00/each	PVMC
Administrative Cost	$ 100.00	PVMC
Emergency intubation reimbursement	$ 900.00	Insurance carrier or private payer.

*(Physician-ER Salary in U.S, 2019). **(CRNA salary in Anchorage, 2019).

Table 2

Project costs

Project Expenses	**Hours or Units**	**Estimated Costs**	**Project Benefits**
Provider labor	3 hours X $137.00 X 6 providers	$2,466.00	Providers gain knowledge and confidence in VL
Cost of project implementation for anesthesia provider	Education: 1 hour Simulation: 2 hours X 6 providers (rate $89.00)	$1,068.00	Fulfillment of request from PVMC to train providers.
Project administration cost	Office supply, thumb drive, etc.	$100.00	
Depreciation of DAT	12 hours	$126.50	
Estimated Total Project Costs:		***$3,760.50***	

Table 3

Reimbursement and number of intubations to recoup project costs

Hospital Reimbursement and associated costs:	**Reimbursement [+/-] Costs**
Average reimbursement for CPT code 31500 Emergency intubation	+$900.00
Disposable or Central processing costs	-$20.00
Use of RPiS	-$40.00
Estimated hospital reimbursement:	$840.00
Number of intubations to recoup project costs: 5	5 X 840 = $4,200.00
Number of intubations to recoup project costs: 5	

Appendix E

Project Task Timeline	Jan. 2020	Feb. 2020	Mar. 2020	Apr. 2020	May. 2020	Jun. 2020	Jul. 2020	Aug. 2020	Sept. 2020	Oct. 2020	Nov. 2020
Project proposal defense		✓									
IRB			✓								
Patient Chart Reviews			✓				✓	✓	✓		
Development of training video		✓	✓	✓							
Distribute Pre-test				✓							
Training and Simulation					✓	✓	✓				
Distribute Post-test								✓			
Data analysis									✓		
Composition of final DNP Project									✓	✓	
DNP defense											✓

Appendix F

Pre-survey

Improving Emergency Airway Care at a CAH

Video Laryngoscope (VL) Direct Laryngoscope (DL)

1.) Clinical Practice Experience: Emergency department:

☐ 1 to 10 years	☐ 11 to 20 years	☐ 21 to 30 years	☐ 31 to 40 + years

2.) I am aware of make and model of VL available at PVMC?

Survey Scale: Check one	**1=Strongly Disagree** ☐	**2=Disagree** ☐	**3=Neutral** ☐	**4=Agree** ☐	**5=Strongly Agree** ☐

3.) Rate your confidence (comfort) with DL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

4.) Rate your confidence (comfort) with VL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

5.) Rate your confidence (comfort) with first-pass intubation (on patient evaluated to be low risk for difficult airway).

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

6.) I am confident that VL is associated with improved glottic view as compared with DL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

7.) I am confident that VL is associated with higher first pass of the ETT as compared with DL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

Post-survey

Improving Emergency Airway Care at a CAH

Video Laryngoscope (VL) Direct Laryngoscope (DL)

1.) Clinical Practice Experience: Emergency department:

☐ 1 to 10 years	☐ 11 to 20 years	☐ 21 to 30 years	☐ 31 to 40 + years

2.) I am aware of make and model of VL available at PVMC?

Survey Scale: Check one	**1=Strongly Disagree** ☐	**2=Disagree** ☐	**3=Neutral** ☐	**4=Agree** ☐	**5=Strongly Agree** ☐

3.) Rate your confidence (comfort) with DL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

4.) Rate your confidence (comfort) with VL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

5.) Rate your confidence with first-pass intubation (on patients evaluated to be low risk for difficult airway).

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

6.) I am confident that VL is associated with improved glottic view as compared with DL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

7.) I am confident that VL is associated with higher first pass of the ETT as compared with DL.

Check One Box	Not at all Confident ☐	Not very Confident ☐	Neutral ☐	Somewhat Confident ☐	Very Confident ☐

8.) Recall your confidence and skill level before the video laryngoscopy training.

Reflect on the training you have received and describe your perception of your

confidence and skill level now:

9.) List 3 items that you have learned after receiving VL training:

1.)

2.)

3.)

10.) What is your perception of the view you obtain when intubating video laryngoscopy?

11.) After receiving the VL training, describe your confidence on obtaining a greater first pass (higher success) of the endotracheal tube:

12.) Describe your experience with video laryngoscopy before and after the VL education:

Appendix G

Storyboard

Storyboard:

Scene:

Description:

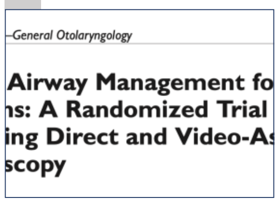
Action:
Audio:
Camera:
Media info:

Hello, my name is Kelly Mitchell and I am a Certified Registered Nurse Anesthetist. I provide anesthesia services to a remote hospital in Alaska. Where I practice, I am the only anesthesia provider in a 250-mile radius. When I am unavailable, the responsibility of urgent or emergent intubation is placed on non-anesthesia providers.

Description:

Action:
Audio:
Camera:
Media info:

This video is being produce specifically for providers who rarely or occasionally have the responsibility of urgently or emergently performing laryngoscopy to achieve endotracheal intubation.



—General Otolaryngology

Airway Management fo
ns: A Randomized Trial
ing Direct and Video-As
scopy

Description:

Action:
Audio:
Camera:
Media info:

There is a large body of evidence that indicates that non-expert providers performing intubation have a higher success of first pass of the ETT with VL as compared to DL.

Storyboard: Scene:


Indian Journal of Anaesthesia

Official publication of the Indian Society of Anaesthesiologists

2019 Oct; 63(10): 781–783.

2019 Oct 10.

IA_738_19: 10.4103/ija.IJA_738_19

eolaryngoscopy as a teaching tool for novices
ntubation results in greater first pass success i
s

atra and Jeson Rajan Doctor

Description: *There are also several studies that show that simulation training with VL is an effective way to translate VL skills to the non-expert provider.*

Action:
Audio:
Camera:
Media info:

Description: *In this video we are going to look at two different video laryngoscopes, one with a non-attached screen and one that has the screen attached.*

Action:
Audio:
Camera:
Media info:

Description: *This VL instruction should be used only by individuals who have been trained and authorized by a physician or used by healthcare providers who have been trained and authorized by the institution providing patient care. This VL instruction is intended to be used in professional healthcare environments such as hospitals who have vetted and authorized qualified professionals to use VL.*

Action:
Audio:
Camera:
Media info:

Storyboard:

Scene:

FLPA 497: Medical Video Methodology

Description: *Introduce Glidescope*

Action:
Audio:
Camera:
Media info:

Description: *Introduce non-attached video monitor*

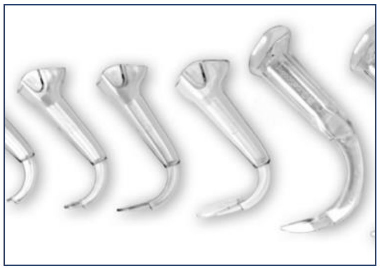
Action:
Audio:
Camera:
Media info:

Description: *Describe video baton*

Action:
Audio:
Camera:
Media info:

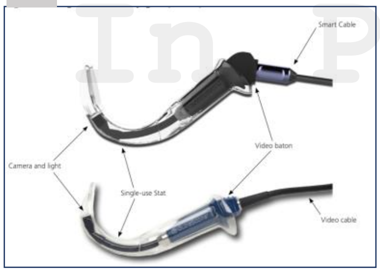
Storyboard:
FLPA 497: Medical Video Methodology

Scene:



Description: *Introduce GVL disposable video baton cover.*

Action:
Audio:
Camera:
Media info:



Description: *Introduce single patient disposable to video baton*

Action:
Audio:
Camera:
Media info:

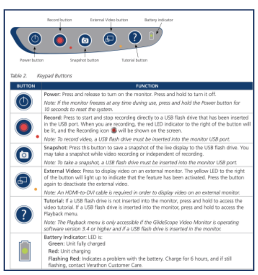


Table 2. Keypad Buttons

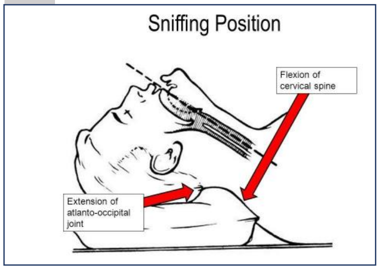
BUTTON	FUNCTION
	Power: Press and release to turn on the monitor. Press and hold to turn it off. *Note: If the monitor freezes at any time during use, press and hold the Power button for 10 seconds to reset the system.*
	Record: Press to start and stop recording directly to a USB flash drive that has been inserted in the USB port. When you are recording, the red LED indicator to the right of the button will be lit, and the Recording icon will be shown on the screen. *Note: To record video, a USB flash drive must be inserted into the monitor USB port.*
	Snapshot: Press this button to save a snapshot of the live display to the USB flash drive. You may take a snapshot while video recording or independent of recording. *Note: To take a snapshot, a USB flash drive must be inserted into the monitor USB port.*
	External Video: Press to display video on an external monitor. The yellow LED to the right of the button will light up to indicate that the feature has been activated. Press the button again to deactivate the external video. *Note: An HDMI-to-DVI cable is required in order to display video on an external monitor.*
	Tutorial: If a USB flash drive is not inserted into the monitor, press and hold to access the video tutorial. If a USB flash drive is inserted into the monitor, press and hold to access the Playback menu. *Note: The Playback menu is only accessible if the GlideScope Video Monitor is operating software version 3.4 or higher and if a USB flash drive is inserted in the monitor.*
	Battery Indicator: LED is: **Green:** Unit fully charged **Red:** Unit charging **Flashing Red:** Indicates a problem with the battery. Charge for 6 hours, and if still flashing, contact Verathon Customer Care.

Description: *Introduce buttons and functionality*

Action:
Audio:
Camera:
Media info:

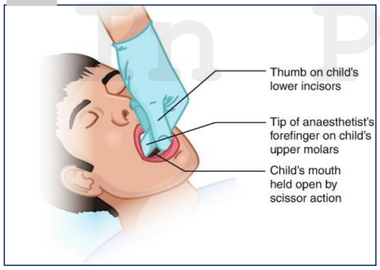
Storyboard:
FLPA 497: Medical Video Methodology

Scene:
Open mouth with a finger/scissor technique.



Description: *Place patient in sniffing position. Stabilize the patient's head.*

Action:
Audio:
Camera:
Media info:



Description: *Open mouth with a finger/scissor technique.*

Action:
Audio:
Camera:
Media info:

Description: *Insert the VL device in the midline, staying opposed to the dorsal surface of the tongue.*

Action:
Audio:
Camera:
Media info:

Storyboard:

Scene:

Description: *With the non-attached monitor style VL, it is recommended to use the 4-STEP TECHNIQUE*

Action:

Audio:

Camera:

Media info:

Description: *Step 1. **Look in the Mouth:** With the video laryngoscope blade in your left hand, introduce it into the midline of the oral pharynx (staying opposed to the dorsal surface of the tongue).*

Action:

Audio:

Camera:

Media info:

Description: *Step 2. **Look at the Screen:** Identify the (uvula) epiglottis, and then manipulate the blade in order to obtain the best glottic view. The distal tip of the blade will be located where it rests in front of or in the vallecula. Do not place the device too close to the glottic inlet as this impedes tube passage. (It only takes about 1 to 3 pounds of lifting force to intubate … so no need to struggle)*

Action:

Audio:

Camera:

Media info:

Storyboard:

Scene:

Step 3. ***Look in the Mouth:*** *Using a GlideRite® Rigid Stylet introduce the ETT (I usually introduce the stylet at the 3 o'clock position and depending on the view that I see, rotate it to the12 o'clock position) Carefully guide the distal tip of the tube into position near the tip of the blade.*

Description:

Action:

Audio:

Camera:

Media info:

Step 4. ***Look at the Screen:*** *Complete the intubation, gently rotating or angling the tube as needed to redirect it. Often the ETT is held like a pencil midway along the length of it. This is the usual position when intubating with DL.*

****Often providers who are intubating obtain good view of the glottic opening, but have trouble manipulating the ETT with this grip. Changing to the "Slot Machine" type grip will eliminate this problem.*

GlideScope Video Monitor

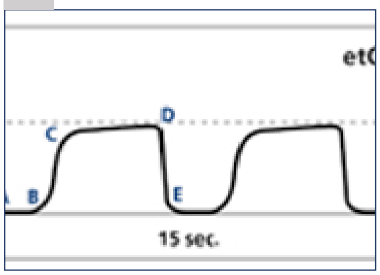
Description:

Action:

Audio:

Camera:

Media info:



Description: *Remove stylet, inflate cuff on ETT and confirm placement with end tidal CO2 and auscultation.*

Action:

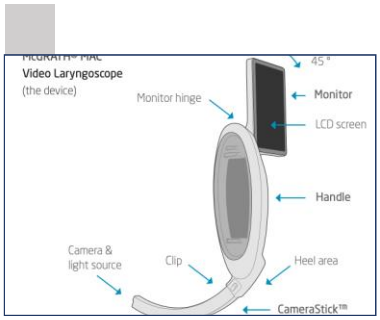
Audio:

Camera:

Media info:

Storyboard:

Scene:



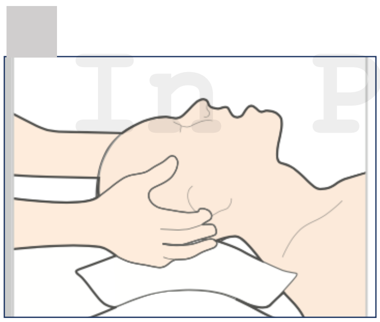
Description: *Power on VL pressing and holding button on side of handle.*

Action:

Audio:

Camera:

Media info:



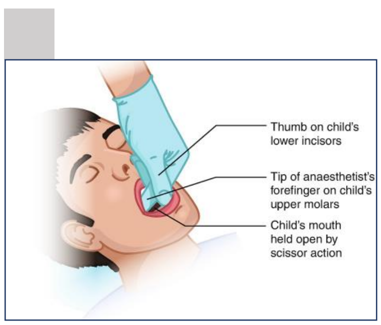
Description: *Place the patient in sniffing the morning air position.*

Action:

Audio:

Camera:

Media info:



Description: *Open mouth with a finger/scissor technique*

Action:

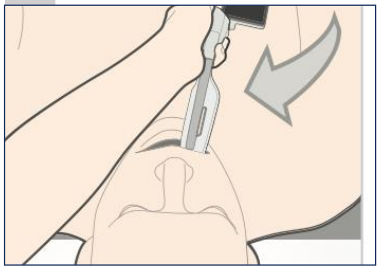
Audio:

Camera:

Media info:

Storyboard:
FLPA 497: Medical Video Methodology

Scene:



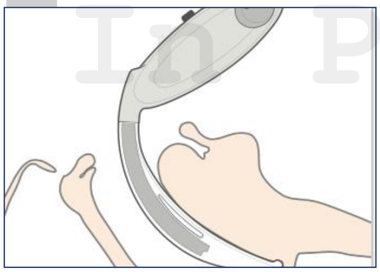
Description: *Advance and rotate the blade around the tongue, staying in the midline, while watching on the video screen to identify key midline airway landmarks (uvula and tip of epiglottis).*

Action:

Audio:

Camera:

Media info:



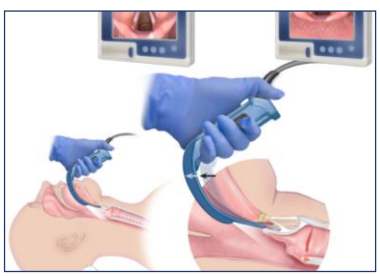
Description: *Advance until the blade rests in the vallecula.*

Action:

Audio:

Camera:

Media info:



Description: *Gently tilt the blade and cranially bring the vocal cords into view on the screen. Do not place the device too close to the glottic inlet as this impedes tube passage.*

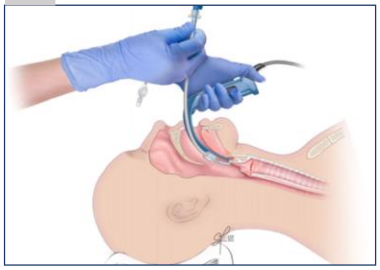
Action:

Audio:

Camera:

Media info:

Storyboard: Scene:



Description: *Use a rigid pre-shaped or a rapid positioning intubating stylet.*

Action:
Audio:
Camera:
Media info:

Description: *Place the stylet-loaded endotracheal tube in the right corner of the mouth with the length of the tube parallel to the ground (3 o'clock position).*

Action:
Audio:
Camera:
Media info:

Description: *Advance the tube while rotating the tube in a counterclockwise position until the tube aligns with the curvature of the blade (12 o'clock position).*

Action:
Audio:
Camera:
Media info:

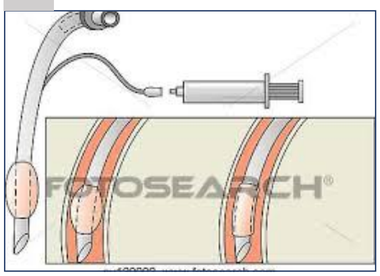
Storyboard: Scene:

Description: *Advance the tube through the vocal cords. If unable to fully pass the tube, withdraw the stylet slightly to allow for more mobility.*

Action:
Audio:
Camera:
Media info:

Description: *Withdraw the stylet.*

Action:
Audio:
Camera:
Media info:



Description: *Inflate the cuff on the endotracheal tube.*

Action:
Audio:
Camera:
Media info:

Storyboard:

Scene:

Description: *Confirm tube placement with breath sounds, chest rise, and colorimetric or quantitative end-tidal carbon dioxide.*

Action:

Audio:

Camera:

Media info:

Appendix H

Training Education

Module 1: Review of airway assessment.

- LEMON Mnemonic.

Look externally (trauma, large incisors, thick facial hair, large tongue).

Evaluate 3-3-2 rule: May indicate difficult airway.

< 3-finger mouth opening.

< 3- finger anteroposterior mandibular space length.

< 2-finger from larynx to chin/neck junction.

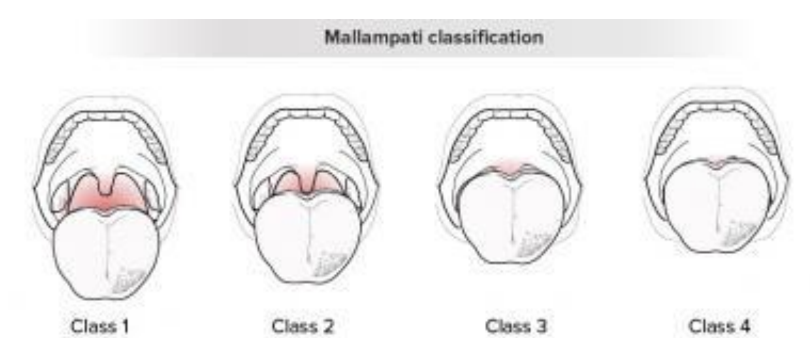
Mallampati classification.

Class 1: full visibility of hard & soft palate; tonsils & uvula.

Class 2: full visibility of hard & soft palate, only upper portion of tonsils & uvula.

Class 3: visibility of hard & soft palate, only the base of the uvula.

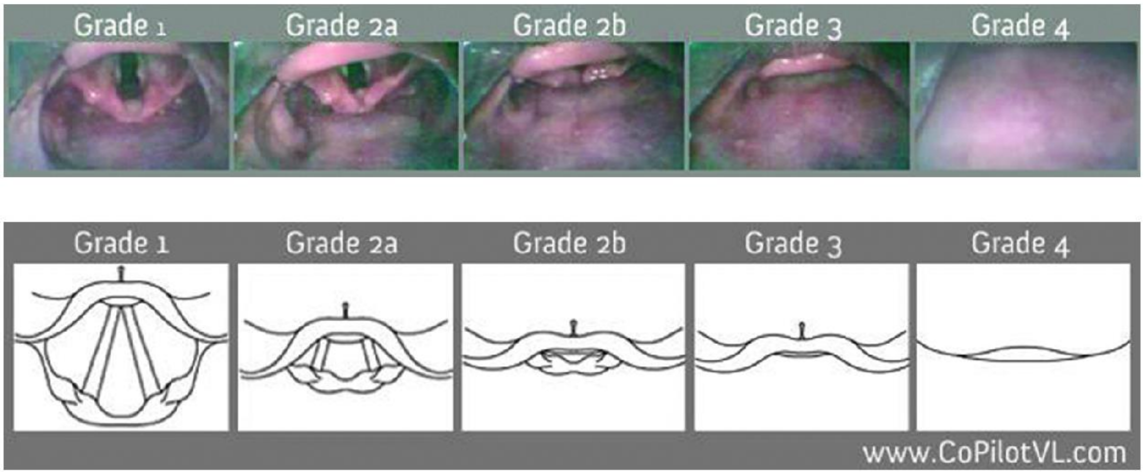
Class 4: visibility of only the hard palate.



Obstruction/obesity (more difficult intubation).

Neck mobility (poor mobility indicative of possible difficult airway).

- Modified Cormack and Lehane system.



Module 2: Review of Rapid Sequence Induction (RSI).

- Pre-oxygenation.

Preoxygenation is accomplished by delivering 100% oxygen at high flow given to a spontaneously breathing patient through a nonrebreather mask for 3 minutes without "bagging" the patient. Studies have shown that 8 vital capacity breaths over 60 seconds results in the same degree of preoxygenation as the standard 3 minutes of tidal volume breathing of 100% oxygen by mask. Apneic oxygenation (N/C at 15 L/min or Hi-Flow N/C) 6 minutes compared with 3.65 minutes

- Positioning: Three-axis theory.
- Cricoid pressure (Selleck maneuver).

To minimize the risk of gastric aspiration, the Sellick maneuver (firm pressure over the thyroid cartilage). Firm backward, upward, and rightward pressure (BURP) on the patient's thyroid cartilage can improve the Cormack/Lehane view up to one full grade.

Induction medications.

Pretreatment medications are typically administered 2-3 minutes prior to induction and paralysis. These medications can be remembered by using the mnemonic LOAD (ie, Lidocaine, Opioid analgesic, Atropine, Defasciculating agents).

Lidocaine (1.5 mg/kg IV; onset 45-90 seconds; duration 10-20 minutes).

Fentanyl (3 mcg/kg IV; onset immediate; duration 0.5 to 1.0 hour).

Atropine (0.02 mg/kg IV; onset rapid; duration 120-180 minutes)

A "defasciculating" dose of a nondepolarizing agent (10% of the paralyzing dose). {pretreatment may help reduce increases in intracranial pressure}.

Induction agents:

Etomidate (Amidate) (0.3 mg/kg IV; onset within 60 seconds; duration 3 to 5 minutes).

Ketamine (Ketalar) (1-2 mg/kg IV; onset within 30 seconds; duration 5 to 10 minutes).

Propofol (Diprivan) (2 mg/kg IV; onset 30 to 45 seconds; dose dependent duration; half-life: 40 minutes).

Midazolam (Versed) (0.3 mg/kg IV; onset within 60 seconds; duration 3 to 5 minutes).)

Paralyzing agents:

Succinylcholine [Anectine] at 2 mg/kg IV; onset 3-5 minutes; duration to 6 hours).

Rocuronium [Zemuron] at 1-1.2 mg/kg IV; onset 1 to 2 minutes; duration 30 to 60 minutes).

Reversing Agent:

Sugammadex (Bridion): Reversal occurs at 1.5 minutes with a dose of 16 mg/kg and at 3 minutes with a dose of 4 mg/kg.

(Medscape. (2020). Retrieved from https://reference.medscape.com/drugs).

Scissors technique to open mouth.

Module 3: Video laryngoscopy (VL).

Hands on use of VL after viewing educational video.

Laryngeal Mask Airway (LMA) for rescue.

Module 4: Simulation

Providers will participate in four simulations, one standard, and one with difficult airway settings utilizing both VL and DL.

Module 5: Tips, Tricks & Pearls.

Demonstration of beer tap or slot machine maneuver.

Combined Video-stylet and Video-laryngoscope for difficult tracheal intubation.

Cricothyroidotomy

Simulation Results form:

Participant: ___________________ **Date:____/_____/____**	**Intubation:**	**Intubated Y/N:**	**Modified Cormack-Lehane View:**
:	Intubation DL Normal		
: Difficult Airway Trainer Engaged:	Intubation DL Difficult		
	Intubation VL Normal		
Difficult Airway Trainer Engaged:	Intubation VL Difficult		